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01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N74-34445*# National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY, SUPPLEMENT 45, JUNE 1974
Jun. 1974 127 p refs
(NASA-SP-7037(45)) Avail: NTIS HC $4.75 CSCL 01A

This special bibliography lists 430 reports, articles, and other documents introduced into the NASA scientific and technical information system in May 1974. Author

N74-34446+ Engineering Sciences Data Unit, London (England).
METHOD FOR PREDICTING THE PRESSURE DISTRIBUTION ON SWEPT WINGS WITH SUBSONIC ATTACHED FLOW
Jun. 1973 65 p refs Supersedes ESDU-TD-Memor-6312 Sponsored by Min. of Def. and Roy. Aeron. Soc.
(ESDU-73012; ESDU-TD-Memor-6312) Copyright. Avail: NTIS HC $314.50

A formula which is used to predict the pressure distribution on swept wings at subsonic speeds is presented. The method is based on the linearized theory for certain special cases with the most important nonlinear terms taken into account so that wings of moderate thickness can be dealt with. The basic formula is quoted for compressible flow. The corresponding formula for incompressible flow is explained. The application of the method to wings in combination with fuselages and other bodies is outlined. A means of replacing the approximate calculation of the linear theory perturbation velocities due to thickness and lift by values obtained from the numerical methods is analyzed. Author

N74-34447+ Engineering Sciences Data Unit, London (England).
ADAPTATION OF DRAG-RISE CHARTS IN T. D. MEMOR. 71019 TO THE MID-SEMI-SPAN PORTION OF SWEPT AND TAPERED PLANFORMS
Nov. 1972 15 p refs Sponsored by Min. of Def. and Roy. Aeron. Soc.
(ESDU-72027) Copyright. Avail: NTIS HC $74.50

The design of aircraft wings to achieve a desired cruise design point without the occurrence of shock wave drag, but beyond which point the onset of shock wave drag is anticipated is discussed. The design point is by definition the drag-rise condition represented by the coefficient of lift and the drag-rise Mach number. Two dimensional flow conditions for a family of airfoils that have a particular form of upper surface pressure distribution at the drag-rise condition are analyzed. The modifications to the basic equations for three dimensional flow conditions are explained. Author

N74-34448*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PROSPECTS FOR REDUCED ENERGY TRANSPORTS: A PRELIMINARY ANALYSIS
M. D. Ardema, M. Harper, C. L. Smith, M. H. Waters, and L. J. Williams Aug. 1974 30 p refs
(NASA-TM-X-62383) Avail: NTIS HC $3.25 CSCL 01A

The recent energy crisis and subsequent substantial increase in fuel prices have provided increased incentive to reduce the fuel consumption of civil transport aircraft. At the present time many changes in operational procedures have been introduced to decrease fuel consumption of the existing fleet. In the future, however, it may become desirable or even necessary to introduce new fuel-conservative aircraft designs. This paper reports the results of a preliminary study of new near-term fuel conservative aircraft. A parametric study was made to determine the effects of cruise Mach number and fuel cost on the optimum configuration characteristics and on economic performance. For each design, the wing geometry was optimized to give maximum return on investment at a particular fuel cost. Based on the results of the parametric study, a nominal reduced energy configuration was selected. Compared with existing transport designs, the reduced energy design has a higher aspect ratio wing with lower sweep, and cruises at a lower Mach number. It has about 30% less fuel consumption on a seat-mile basis. Author

N74-34449*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
DRAG REDUCTIONS OBTAINED BY MODIFYING A BOX-SHAPED GROUND VEHICLE
Edwin J. Saltzman, Robert R. Meyer, Jr., and David P. Lux Oct. 1974 29 p refs
(NASA-TM-X-56027) Avail: NTIS HC $3.25 CSCL 01A

A box-shaped ground vehicle was used to simulate the aerodynamic drag of high volume transports, that is, delivery vans, trucks, or motor homes. The coast-down technique was used to define the drag of the original vehicle, having all square corners, and several modifications of the vehicle. Test velocities ranged up to 65 miles per hour, which provided maximum Reynolds numbers of 1 times 10 to the 7th power based on vehicle length. One combination of modifications produced a reduction in aerodynamic drag of 61 percent as compared with the original square-cornered vehicle. Author

N74-34450*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AERODYNAMIC PERFORMANCE OF A 1.25-PRESSURE-RATIO AXIAL-FLOW FAN STAGE
Royce D. Moore and Ronald J. Steinke Washington Aug. 1974 122 p refs
(NASA-TM-X-3083; E-7800) Avail: NTIS HC $4.50 CSCL 01A

Aerodynamic design parameters and overall and blade-element performances of a 1.25-pressure-ratio fan stage are reported. Detailed radial surveys were made over the stable operating flow range at rotative speeds from 70 to 120 percent of design speed. At design speed, the measured stage peak efficiency of 0.872 occurred at a weight flow of 34.92 kilograms

per second and a pressure ratio of 1.242. Stage stall margin is about 20 percent based on the peak efficiency and stall conditions. The overall peak efficiency for the rotor was 0.911. The overall stage performance showed no significant change when the stators were positioned at 1, 2, or 4 chords downstream of the rotor.
Author

N74-34451# National Aerospace Lab., Tokyo (Japan).
A TECHNIQUE USING A CURVE FITTING METHOD FOR IDENTIFYING THE STABILITY DERIVATIVES FROM FLIGHT TEST RECORDS
Goro Beppu and Toshiho Sakai 1974 16 p refs In JAPANESE; ENGLISH summary
(NAL-TR-356) Avail: NTIS HC $4.00

For designing the autopilot of an airplane, and for investigating stability and control characteristics of an airplane, the stability derivatives of the airplane must be known. Therefore, various methods for determining stability derivatives from flight test data were investigated. The response of an airplane to control surface deflection, which was displaced in flight test, is calculated, using assumed stability derivatives. Then a cost function J, which is the squared value of the difference between the calculated response and the response obtained in flight, is estimated. By applying the modified steepest descent method, the stability derivatives are amended into new ones so as to make J small. The calculations are repeated iteratively until J becomes very small. This method is used for determining lateral stability derivatives from flight test data. The problems, which are generated when this method is put into practical use, are discussed.
Author

N74-34452*# Scripta Technica, Inc., Washington, D.C.
HEAT-MASS TRANSFER AND FRICTION IN A TURBULENT BOUNDARY LAYER
S. S. Kutateladze and A. I. Leontyev NASA Sep. 1974 288 p refs Transl. into ENGLISH of the book "Teplo-Massoobmen i Treniye v Turbulentnom Pogranichnom Sloye" Moscow, Energiya Press, 1972 344 p
(Contract NASw-2484)
(NASA-TT-F-805) Avail: NTIS HC $6.75 CSCL 01A

Conservative properties are analyzed of the turbulent boundary layer at a wall. The concept of an ideal turbulent boundary layer with a degenerate viscous region is introduced; its properties are analyzed, and the theory of limiting friction and heat exchange at the surfaces of bodies immersed in flows with Reynolds numbers approaching infinity is presented. Problems connected with application of this theory of finite Reynolds numbers are discussed, experimental data are cited, and practical applications are indicated.
Author

N74-34453*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FLIGHT REYNOLDS NUMBER EFFECTS ON A FIGHTER-TYPE, CIRCULAR-ARC-19 DEG CONIC BOATTAIL NOZZLE AT SUBSONIC SPEEDS
Roger Chamberlin Washington Oct. 1974 31 p refs
(NASA-TM-X-3121; E-7997) Avail: NTIS HC $3.25 CSCL 01A

A circular-arc - conic boattail nozzle, typical of those used on a twin engine fighter, was tested on an underwing nacelle mounted on an F-106B aircraft. The boattail had a radius ratio r/r sub c of 0.41 and a terminal boattail angle of approximately 19 deg. The gas generator was a J85-GE-13 turbojet engine. The effects of Reynolds number and angle of attack on boattail pressure drag and boattail pressure profiles were investigated. Increasing Reynolds number resulted in reduced boattail drag at both Mach numbers of 0.6 and 0.9.
Author

N74-34454*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THEORETICAL SURFACE VELOCITY DISTRIBUTIONS ON ACOUSTIC SPLITTER GEOMETRIES FOR AN ENGINE INLET
James A. Albers and Douglas C. Breunlin Washington Oct. 1974 23 p refs
(NASA-TM-X-3114; E-8001) Avail: NTIS HC $3.00 CSCL 20D

The potential-flow velocity distributions on several splitter geometries in an engine inlet and their variation with different splitter leading-edge shapes and distances from the inlet highlight were analyzed. The velocity distributions on the inner and outer surfaces of the splitters are presented for low-speed and cruise conditions. At zero incidence angle, the splitter with the 4-to-1 elliptical leading edge had lower peak velocities and velocity gradients than the splitter with the 2-to-1 elliptical leading edge. The velocity gradients decreased as the distance from the inlet highlight to the splitter leading edge was increased. For a given distance, the peak velocity on the splitter inner surface increased with increasing inlet incidence angle. At an incidence angle of 50 deg, the velocity level and gradients on the inner surface of the splitter in the forward position were sufficiently severe to suggest local separation.
Author

N74-34455*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EXPERIMENTAL EVALUATION OF COMPLIANT SURFACES AT LOW SPEEDS
Kenneth W. McAlister and Tom M. Wynn Washington Oct. 1974 32 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Moffett Field, Calif.
(NASA-TM-X-3119; A-5596) Avail: NTIS HC $3.25 CSCL 01A

An experimental study was devised to determine the profile drag on a subsonic wind tunnel model partially covered with various compliant surface materials. The model consisted of a large section of constant thickness bounded fore and aft by symmetric airfoil fairings. A flat rigid plate, the control surface, could be exchanged for four contiguous complaint panels. The flexible media generally consisted of thin polyvinylchloride membranes stretched to various tensions over trapped fluid cavities of air, water, or polyethelene oxide solution, or over dry or flooded open-celled polyurethane foams. On the basis of very accurate direct-force cell measurements, all configurations were found to yield profile drags equal to or slightly higher than that obtained for the conventional rigid surface case. The results indicate that the potential for practical drag-reducing applications will be limited to either high-density or high-speed flows where more sensible pressure perturbations occur.
Author

N74-34456*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
GUST ALLEVIATION FOR A STOL TRANSPORT BY USING ELEVATOR, SPOILERS, AND FLAPS
Frederick J. Lallman Washington Oct. 1974 82 p refs
(NASA-TN-D-7559; L-9250) Avail: NTIS HC $4.00 CSCL 01C

Control laws were developed to investigate methods of alleviating the response of a STOL transport to gusty air. The transport considered in the study had triple-slotted, externally blown jet flaps and a large T-tail. The control devices used were the elevator, spoilers, and flaps. A hybrid computing system was used to simulate linearized longitudinal dynamics of the aircraft and to implement a conjugate gradient optimal search algorithm. The aircraft was simulated in the low-speed approach condition only. Feedback control matrices were found which minimized the average of a quadratic functional involving passenger compartment accelerations, pitch angle and rate, flight path angle and speed variations. The optimization was performed for artificially designed gust inputs in the form of predetermined rectangular waveforms. Results were obtained for elevator, spoilers, and flaps acting singly and in combination. Additional results were obtained for unit sinusoidal gust inputs by using the gain matrices computed for the artificial test gusts. Various sensor configurations were also investigated.
Author

N74-34457*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOME OBSERVATIONS ABOUT THE COMPONENTS OF TRANSONIC FAN NOISE FROM NARROW-BAND SPECTRAL ANALYSIS
Arthur V. Saule Washington Oct. 1974 32 p refs
(NASA-TN-D-7788; E-7989) Avail: NTIS HC $3.25 CSCL 01A

Qualitative and quantitative spectral analyses are presented that give the broadband-noise, discrete-tone, and multiple-tone properties of the noise generated by a full-scale high-bypass

single-stage axial-flow transonic fan (fan B, NASA Quiet Engine Program). The noise components were obtained from narrow-band spectra in conjunction with 1/3-octave-band spectra. Variations in the pressure levels of the noise components with fan speed, forward-quadrant azimuth angle, and frequency are presented and compared. The study shows that much of the apparent broadband noise on 1/3-octave-band plots consists of a complex system of shaft-order tones. The analyses also indicate the difficulties in determining or defining noise components, especially the broadband level under the discrete tones. The sources which may be associated with the noise components are discussed. Author

N74-34458# Aeronautical Research Labs., Melbourne (Australia).
PRESSURE, FORCE AND CROSS-FLOW DRAG DISTRIBUTIONS ON MODERATELY BLUNT CONE-CYLINDER BODIES AT MACH 7.5
A. S. Kaye and M. J. Williams Jan. 1974 74 p refs
(ARL/A-142) Avail: NTIS HC $6.75

Measured pressure and force distributions and surface flow patterns at Mach 7.5 for a series of cone cylinder models of nose semi-angles of 30 and 45 degrees, at angles of incidence up to 14 degrees are discussed. Zero incidence pressure distributions agree with the method of characteristics results except near the shoulder. The initial derivative with incidence of the normal local loading on the afterbody is significantly less than predicted. The nonlinear component of the cross flow drag coefficient is found to correlate well with the cross-flow parameter except in the immediate vicinity of the axial station of the initial onset of separation. The normal force coefficient is found to become less significantly nonlinear with incidence and the center of pressure location is sensitive to incidence only for afterbody lengths greater than about three diameters. Author

N74-34459*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXTENSION OF LEADING-EDGE-SUCTION ANALOGY TO WINGS WITH SEPARATED FLOW AROUND THE SIDE EDGES AT SUBSONIC SPEEDS
John E. Lamar Washington Oct. 1974 73 p refs
(NASA-TR-R-428; L-9460) Avail: NTIS HC $3.75 CSCL 01A

A method for determining the lift, drag, and pitching moment for wings which have separated flow at the leading and side edges with subsequently reattached flow downstream and inboard is presented. Limiting values of the contribution to lift of the side-edge reattached flow are determined for rectangular wings. The general behavior of this contribution is computed for rectangular, cropped-delta, cropped-diamond, and cropped-arrow wings. Comparisons of the results of the method and experiment indicate reasonably good correlation of the lift, drag, and pitching moment for a wide planform range. The agreement of the method with experiment was as good as, or better than, that obtained by other methods. The procedure is computerized and is available from COSMIC as NASA Langley computer program A0313. Author

N74-34460*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
FLIGHT-DETERMINED LAG OF ANGLE-OF-ATTACK AN ANGLE-OF-SIDESLIP SENSORS IN THE YF-12A AIRPLANE FROM ANALYSIS OF DYNAMIC MANEUVERS
Glenn B. Gilyard and Daumants Belte Washington Oct. 1974 32 p refs
(NASA-TN-D-7819; H-767) Avail: NTIS HC $3.25 CSCL 01A

Magnitudes of lags in the pneumatic angle-of-attack and angle-of-sideslip sensor systems of the YF-12A airplane were determined for a variety of flight conditions by analyzing stability and control data. The three analysis techniques used are described. An apparent trend with Mach number for measurements from both of the differential-pressure sensors showed that the lag ranged from approximately 0.15 second at subsonic speed to 0.4 second at Mach 3. Because Mach number was closely related to altitude for the available flight data, the individual effects of Mach number and altitude on the lag could not be separated clearly. However, the results indicated the influence of factors other than simple pneumatic lag. Author

N74-34461*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LONGITUDINAL AERODYNAMIC CHARACTERISTICS OF AN EXTERNALLY BLOWN FLAP POWERED LIFT MODEL WITH SEVERAL PROPULSIVE SYSTEM SIMULATORS
Danny R. Hoad Washington Sep. 1974 143 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Hampton, Va.
(NASA-TN-D-7670; L-9538) Avail: NTIS HC $4.75 CSCL 01C

An investigation of a four-engine externally blown flap (EBF) powered-lift transport was conducted in the Langley V/STOL tunnel to determine the effect of different engine configurations on the longitudinal aerodynamic characteristics. The different engine configurations were simulated by five different sets of propulsion simulators on a single aircraft model. Longitudinal aerodynamic data were obtained for each simulator on each flap deflection corresponding to cruise, take-off, and landing at a range of angles of attack and various thrust coefficients. The bypass ratio (BPR) 6.2 engine simulator provided the best lift and drag characteristics of the five simulators tested in the take-off and landing configurations. The poor performance of the BPR 10.0 and 3.2 engine simulators can be attributed to a mismatch of engine-model sizes or poor engine location and orientation. Isolated engine wake surveys indicated that a reasonable assessment of the aerodynamic characteristics of an engine-wing-flap configuration could be made if qualitative information were available which defined the engine wake characteristics. All configurations could be trimmed easily with relatively small horizontal-tail incidence angles; however, the take-off landing configurations required a high-lift tail. Author

N74-34462*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
WIND-TUNNEL INVESTIGATION OF AN EXTERNALLY BLOWN FLAP STOL TRANSPORT MODEL INCLUDING AND INVESTIGATION OF WALL EFFECTS
Garl L. Gentry, Jr. Washington Sep. 1974 174 p refs
(NASA-TM-X-3009) Avail: NTIS HC $5.00 CSCL 01A

A wind-tunnel investigation was conducted in the Langley V/STOL tunnel and in a scaled version of the Ames 40- by 80-foot tunnel test section installed as a liner in the Langley V/STOL tunnel to determine the effect of test-section size on aerodynamic characteristics of the model. The model investigated was a swept-wing, jet-powered, externally blown flap (EBF) STOL transport configuration with a leading-edge slat and triple-slotted flaps. The model was an 0.1645-scale model of a 11.58-meter (38.0-ft) span model designed for tests in a 40- by 80-foot tunnel. The data compare the aerodynamic characteristics of the model with and without the tunnel liner installed. Data are presented as a function of thrust coefficient over an angle-of-attack range of 0 deg to 25 deg. A thrust-coefficient range up to approximately 4.0 was simulated, most ot the tests being conducted at a free-stream dynamic pressure of 814 Newtons/sq m (17 lb sq ft). The data are presented with a minimum of analysis. Author

N74-34463# General Dynamics Corp., San Diego, Calif.
FINITE DIFFERENCE CALCULATIONS OF THE NACA 64 A-410 AIRFOIL OSCILLATING SINUSOIDALLY IN PITCH AT M INFINITY EQUALS 0.72
R. Magnus and H. Yoshihara 1 Aug. 1974 40 p refs
(Contract N00014-73-C-0294)
(AD-782684; CASD-NSC-74-004) Avail: NTIS CSCL 01/1

A finite difference procedure based upon the exact unsteady inviscid adiabatic flow equations is used to calculate the flow over a NACA 64A-410 airfoil oscillating sinusoidally in pitch at M sub infinity = 0.72. At the reduced frequencies k = 0.2 and 1.0 the amplitude of the pitch is 2 degrees about the mean incidence of 2 degrees, while at the reduced frequency k = 5.0, the amplitude is reduced to 0.4 degrees. (The airfoil chord is used in defining k.) The resulting unsteady chordwise pressure distributions, and the time variations of CL and CM, all in the periodic stage, are given for the three values of k. Author (GRA)

N74-34505* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

THEORY AND COMPARISON WITH TESTS OF TWO FULL-SCALE PROPROTORS
Wayne Johnson (Army Air Mobility R and D Lab., Moffett Field, Calif.) *In* Its Rotorcraft Dyn. 1974 p 159-169 refs (For availability see N74-34489 24-02)
CSCL 01A

N74-34506* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPERIMENTAL AND ANALYTICAL STUDIES IN TILT-ROTOR AEROELASTICITY
Raymond G. Kvaternik *In* Its Rotorcraft Dyn. 1974 p 171-184 refs (For availability see N74-34489 24-02)
CSCL 01A

N74-34509* Delaware Univ., Newark.
OPEN AND CLOSED LOOP STABILITY OF HINGELESS ROTOR HELICOPTER AIR AND GROUND RESONANCE
Maurice I. Young, David J. Bailey, and Murray S. Hirschbein *In* NASA. Ames Res. Center Rotorcraft Dyn. 1974 p 205-218 refs (For availability see N74-34489 24-02)
(Grant DA-ARO(D)-1-247-G112)
CSCL 01A

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N74-34464 + Engineering Sciences Data Unit, London (England).
LOST RANGE, FUEL AND TIME DUE TO CLIMB AND DESCENT: AIRCRAFT WITH TURBO-JET AND TURBO-FAN ENGINES
Aug. 1974 13 p refs Sponsored by Roy. Aeron. Soc.
(ESDU-74018) Copyright. Avail: NTIS HC $36.00

An approximate method for estimating lost range, lost fuel and lost time due to climb and descent is presented. The use of these quantities permits estimates of still-air range, fuel and time based on cruise performance alone to be adjusted for the net loss of energy during climb (including acceleration) and descent (including deceleration). The method is best suited to preliminary calculations at a stage when the available airframe and engine data are minimal and for cases where the distances flown in climb and descent are not a substantial part of the total flight distance. Author

N74-34465*# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
AIRCRAFT RANGE OPTIMIZATION USING SINGULAR PERTURBATIONS Ph.D. Thesis
Joseph Taffe OConnor Jun. 1973 180 p refs
(Contract NAS9-4065; DSR Proj. 55-23890)
(NASA-CR-140519; T-597) Avail: NTIS HC $12.00 CSCL 01B

An approximate analytic solution is developed for the problem of maximizing the range of an aircraft for a fixed end state. The problem is formulated as a singular perturbation and solved by matched inner and outer asymptotic expansions and the minimum principle of Pontryagin. Cruise in the stratosphere, and on transition to and from cruise at constant Mach number are discussed. The state vector includes altitude, flight path angle, and mass. Specific fuel consumption becomes a linear function of power approximating that of the cruise values. Cruise represents the outer solution; altitude and flight path angle are constants, and only mass changes. Transitions between cruise and the specified initial and final conditions correspond to the inner solutions. The mass is constant and altitude and velocity vary. A solution is developed which is valid for cruise but which is not for the initial and final conditions. Transforming of the independent variable near the initial and final conditions result in solutions which are valid for the two inner solutions but not for cruise. The inner solutions can not be obtained without simplifying the state equations. The singular perturbation approach overcomes this difficulty. A quadratic approximation of the state equations is made. The resulting problem is solved analytically, and the two inner solutions are matched to the outer solution. Author

N74-34466*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PARAMETER ESTIMATION OF POWERED-LIFT STOL AIRCRAFT CHARACTERISTICS INCLUDING TURBULENCE AND GROUND EFFECTS
Rodney C. Wingrove Sep. 1974 11 p refs
(NASA-TM-X-62382) Avail: NTIS HC $3.00 CSCL 01C

The estimation of longitudinal aerodynamic coefficients from data recorded during flight tests of a powered-lift STOL aircraft is considered. First, a comparison is made between the coefficient values determined by the regression and quasilinearization identification techniques from records taken during elevator pulse maneuvers. The results show that for these tests the regression method provides less scatter in coefficient estimates and provides better correlation with the predicted values. Special techniques are then developed which allow identification of the coefficients from records taken during landing maneuvers in which the aircraft encounters turbulence while flying in ground effect. Flight test results are presented to illustrate the effects of air turbulence and ground proximity on the estimated coefficient values. Author

N74-34467*# Boeing Commercial Airplane Co., Seattle, Wash.
THE RESULTS OF A LOW-SPEED WIND TUNNEL TEST TO INVESTIGATE THE EFFECTS OF THE REFAN JT8D ENGINE TARGET THRUST REVERSER ON THE STABILITY AND CONTROL CHARACTERISTICS OF THE BOEING 727-200 AIRPLANE
E. A. Kupcis Jul. 1974 52 p
(Contract NAS3-17842)
(NASA-CR-134699; BCAC-D6-41908) Avail: NTIS HC $5.75 CSCL 01C

The effects of the Refan JT8D side engine target thrust reverser on the stability and control characteristics of the Boeing 727-200 airplane were investigated using the Boeing-Vertol 20 x 20 ft Low-Speed Wind Tunnel. A powered model of the 727-200 was tested in groud effect in the landing configuration. The Refan target reverser configuration was evaluated relative to the basic production 727 airplane with its clamshell-deflector door thrust reverser design. The Refan configuration had slightly improved directional control characteristics relative to the basic airplane. Clocking the Refan thrust reversers 20 degrees outboard to direct the reverser flow away from the vertical tail, had little effect on directional control. However, clocking them 20 degrees inboard resulted in a complete loss of rudder effectiveness for speeds greater than 90 knots. Variations in Refan reverser lip/fence geometry had a minor effect on directional control. Author

N74-34468*# Aeronautical Research Associates of Princeton, Inc., N.J.
SURVEY OF AIRCRAFT SUBCRITICAL FLIGHT FLUTTER TESTING METHODS
Robert Rosenbaum Aug. 1974 30 p refs
(Contract NAS1-11672)
(NASA-CR-132479; ARAP-218) Avail: NTIS HC $3.25 CSCL 01C

The results of a survey of U. S., British and French subcritical aircraft flight flutter testing methods are presented and evaluation of the applicability of these methods to the testing of the space shuttle are discussed. Ten U. S. aircraft programs covering the large civil transport aircraft and a variety of military aircraft are reviewed. In addition, three major French and British programs are covered by the survey. The significant differences between the U. S., French and British practices in the areas of methods of excitation, data acquisition, transmission and analysis are reviewed. The effect of integrating the digital computer into the flight flutter test program is discussed. Significant saving in analysis and flight test time are shown to result from the use of special digital computer routines and digital filters. Author

N74-34469*# McDonnell-Douglas Corp., Long Beach, Calif.
AN ANALYSIS OF THE IMPACT OF CABIN FLOOR ANGLE RESTRICTIONS ON L/D FOR A TYPICAL SUPERSONIC TRANSPORT
R. L. Radkey Aug. 1974 54 p refs
(Contract NAS1-13145)
(NASA-CR-132508) Avail: NTIS HC $3.75 CSCL 01C

High floor angles at cruise have been identified as a significant problem facing airline and public acceptance of a supersonic transport. In order to explore the relationship between cruise performances and floor angle, four related wing-fuselage design and integration studies have been conducted. The studies were: (1) a fuselage camber study in which perturbations in the fuselage camber distribution were examined with a baseline wing, (2) a wing optimization study in which wings were optimized for minimum drag at C sub L's less than the design C sub L. These wings were optimized as wing planform camber surfaces alone and evaluated with a baseline fuselage, (3) a second wing optimization study in which wings were optimized for minimum drag at C sub L's less than the design C sub L but for this study the wings were optimized in the presence of the baseline fuselage, and (4) a third wing optimization study in which wings were optimized for minmum drag subject to C sub M constraints designed to produce more positive C sub MO's, thereby reducing trim drag. The studies indicated that it was not possible to both improve the aircraft cruise L/D and substantially reduce the cruise floor angle. The studies did indicate that the cruise floor angle could be reduced by reducing the fuselage incidence relative to the wing, but the reduction in floor angle was accompanied by a substantial reduction in L/D. Author

N74-34470# Committee on Aeronautical and Space Sciences (U. S. Senate).
ADVANCED AERONAUTICAL CONCEPTS
Washington GPO 1974 341 p refs Hearing before Comm. on Aeron. and Space Sci., 93d Congr., 2d Sess., 16 and 18 Jul. 1974
(GPO-38-266) Avail: SOD HC $3.25

Aeronautical concepts in transportation are discussed that predict lighter-than-air vehicles, new engines, and operational techniques for reduced fuel consumption. G.G.

N74-34471*# Aeronautical Research Associates of Princeton, Inc., N.J.
SUBCRITICAL FLUTTER TESTING AND SYSTEM IDENTIFICATION
John C. Houbolt Aug. 1974 113 p refs
(Contract NAS1-11672)
(NASA-CR-132480; ARAP-219) Avail: NTIS HC $4.50 CSCL 01C

Treatment is given of system response evaluation, especially in application to subcritical flight and wind tunnel flutter testing of aircraft. An evaluation is made of various existing techniques, in conjuction with a companion survey which reports theoretical and analog experiments made to study the identification of system response characteristics. Various input excitations are considered, and new techniques for analyzing response are explored, particularly in reference to the prevalent practical case where unwanted input noise is present, such as caused by gusts or wind tunnel turbulence. Further developments are also made of system parameter identification techniques. Author

N74-34472# Sandia Labs., Albuquerque, N.Mex.
COMPUTER GENERATED VISUAL DOCUMENTATION OF THEORETICAL STORE SEPARATION ANALYSES
Harold R. Spahr [1974] 28 p refs Sponsored by AEC
Avail: NTIS HC $4.50

Store separation problems and their analysis continue to be important in determining the effectiveness of any aircraft delivered weapons system, since failures can result in reductions in the allowable delivery speed of the weapon, increased dispersion of the impact point or target intercept point, as well as lead to the possible loss of the aircraft. The MOVIE1 computer program is described which uses state of the art techniques to provide rapid visual documentation of the theoretical store separation process at minimum cost. Black and white drawings of two theoretical store separation analyses are presented to illustrate the visual documentation provided. Color and black and white 35mm slides, and color and black and white movies (with real time and slow motion sequences) of the theoretical store separation process can also be generated. Techniques are discussed which reduce the computer time required for one theoretical store separation for the generation of magnetic tape for drawings, and to a few minutes for the generation of magnetic tape for movies. Author

N74-34473# Committee on Science and Astronautics (U. S. House).
ADVANCED SUPERSONIC TECHNOLOGY
Washington GPO 1974 255 p Hearing before Subcomm. on Aeron. and Space Technol. of Comm. on Sci. and Astronaut., 93d Congr., 2d Sess., No. 39, 22 Feb. 1974
(GPO-39-784) Avail: Subcomm. on Aeron. and Space Technol.

The following subjects are examined: (1) fuel conservation measures for current and future subsonic aircraft, primarely from a technological point of view; (2) prospects and problems involving the use of hydrogen as an aviation fuel; and (3) the technological base for advanced supersonic flight. G.G.

N74-34474*# Scientific Translation Service, Santa Barbara, Calif.
CONTRIBUTIONS OF THE DFVLR TO THE INVESTIGATION OF RESCUE AND RECOVERY SYSTEMS
Karl Friedrich Doherr and Peter Hamel Washington NASA Oct. 1974 30 p refs Transl. into ENGLISH from Z. Flugwiss. (West Germany), v. 22, May 1974 p 153-163
(Contract NASw-2483)
(NASA-TT-F-15958) Avail: NTIS HC $4.50 CSCL 01C

A scientific investigation of rescue and recovery systems is reported. Presented are designated projects and investigation methods, as well as special test facilities and equipment. Some of the parachute systems developed by DFVLR are discussed. Author

N74-34475*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HINGELESS HELICOPTER ROTOR WITH IMPROVED STABILITY Patent Application
Robert A. Ormiston, William G. Bousman, Dewey H. Hodges, and David A. Peters, inventors (to NASA) Filed 10 Oct. 1974 22 p Prepared in cooperation with Army Air Mobility R and D Lab.
(NASA-Case-ARC-10807-1; US-Patent-Appl-SN-513612) Avail: NTIS HC $4.25 CSCL 01B

Improved stability is provided in a hingeless helicopter rotor by inclining the principal elastic flexural axes and coupling pitching of the rotor blade with the lead-lag bending of the blade. The primary elastic flex axes can be inclined by constructing the blade of materials that display nonuniform stiffness. The specification describes various cross section distributions and the inclined flex axes resulting therefrom. Also described are arrangements for varying the pitch of the rotor blade in a predetermined relationship with lead-lag bending of the blade, i.e., bending of the blade in a plane parallel to its plane of rotation. NASA

N74-34476*# Systems Technology, Inc., Hawthorne, Calif.
VEHICLE DESIGN CONSIDERATIONS FOR ACTIVE CONTROL APPLICATION TO SUBSONIC TRANSPORT AIRCRAFT Final Report
L. Gregor Hofmann and Warren F. Clement Washington NASA Aug. 1974 148 p refs Prepared in cooperation with McDonnell Douglas Astronautics Co., Huntington Beach, Calif.
(Contracts NAS1-12436; LS-2975-A3)
(NASA-CR-2408; TR-2037-1) Avail: NTIS HC $4.75 CSCL 01B

The state of the art in active control technology is summarized. How current design criteria and airworthiness regulations might restrict application of this emerging technology to subsonic CTOL transports of the 1980's are discussed. Facets of active control technology considered are: (1) augmentation of relaxed inherent stability; (2) center-of-gravity control; (3) ride quality control; (4) load control; (5) flutter control; (6) envelope limiting, and (7) pilot interface with the control system. A summary and appraisal of the current state of the art, design criteria, and recommended practices, as well as a projection of the risk in

applying each of these facets of active control technology is given. A summary of pertinent literature and technical expansions is included. Author

N74-34477*# Lockheed-Georgia Co., Marietta.
FEASIBILITY STUDY OF THE TRANSONIC BIPLANE CONCEPT FOR TRANSPORT AIRCRAFT APPLICATION
R. H. Lange, J. F. Cahill, E. S. Bradley, R. R. Eudaily, C. M. Jenness, and D. G. MacWilkinson Jun. 1974 138 p refs
(Contract NAS1-12413)
(NASA-CR-132462; LG74ER0077) Avail: NTIS HC $4.75 CSCL 01C

Investigations were conducted to evaluate the feasibility of a transonic biplane consisting of a forward-mounted swept-back lower wing, a rear-mounted swept-forward upper wing, and a vertical fin connecting the wings at their tips. This wing arrangement results in significant reductions in induced drag relative to a monoplane designed with the same span, and it allows for a constant-section fuselage shape while closely matching an ideal area distribution curve for M = 0.95 cruise. However, no significant reductions in ramp weight were achieved for the biplane relative to a monoplane with the same mission capability. Flutter analyses of the biplane revealed both symmetric and antisymmetric instabilities that occur well below the required flutter speed. Further studies will be required to determine if acceptable flutter speeds can be achieved through the elimination of the instabilities by passive means or by active controls. Configurations designed for other missions, especially those with lower Mach numbers and lower dynamic pressures, should be examined since the geometries suitable for those design constraints might avoid the weight penalties and flutter instabilities which prevent exploitation of induced drag benefits for the configuration studied. Author

N74-34478*# Washington Univ., Seattle. Dept. of Aeronautics and Astronautics.
DEVELOPMENT AND APPLICATION OF A NON-GAUSSIAN ATMOSPHERIC TURBULENCE MODEL FOR USE IN FLIGHT SIMULATORS
P. M. Reeves, G. S. Campbell, V. M. Ganzer, and R. G. Joppa Washington NASA Sep. 1974 154 p refs
(Grant NGR-48-002-085)
(NASA-CR-2451) Avail: NTIS HC $5.00 CSCL 14B

A method is described for generating time histories which model the frequency content and certain non-Gaussian probability characteristics of atmospheric turbulence including the large gusts and patchy nature of turbulence. Methods for time histories using either analog or digital computation are described. A STOL airplane was programmed into a 6-degree-of-freedom flight simulator, and turbulence time histories from several atmospheric turbulence models were introduced. The pilots' reactions are described. Author

N74-34479# National Aerospace Lab., Tokyo (Japan).
SEMI-CONSTRAINED HEIGHT CONTROL TESTS OF FLYING TEST BED FOR VTOL AIRCRAFT
Naoto Takizawa, Yoshito Miyamoto, Tadao Kai, Yoshikazu Tanabe, Akiyoshi Shibuya, Toshio Ogawa, Hirotoshi Fujieda, Koichi Ono, Tadao Torisaki, and Yoshio Goto 1974 64 p refs In JAPANESE; ENGLISH summary
(NAL-TR-358) Avail: NTIS HC $6.25

The flying test bed (FTB), developed for the purpose of studying the problems associated with hovering, vertical takeoff, and vertical landing of VTOL aircraft, was installed between two upright rails in a gantry of 9 m height and set on three 2 m stands. The permitted vertical movement was about 3.5 m. Running tests by remote control, ground operations tests by the crew, and climb and descent tests by the crew were carried out. The flight tasks given to two pilots were takeoff and landing, hover, climb, and descent by slow and step control. The height control test results showed that the height control systems, including the automatic stabilization equipment, have good speed-control-characteristics and sensitivity, although there was some backlash in the systems. The hovering characteristics were influenced by static friction between the FTB and rails, which assisted the pilot in achieving hover, but disturbed the pilot in leaving hover condition. Author

N74-34480# National Aerospace Lab., Tokyo (Japan).
AN EXPERIMENTAL INVESTIGATION ON THE TRANSONIC FLUTTER CHARACTERISTICS OF THE CANTILEVER SWEPT-BACK WING WITH AIRFOIL SECTION AND COMPARISON WITH THE THIN CANTILEVER SWEPT-BACK WING
Toshiyuki Morita, Eiichi Nakai, and Takao Kikuchi 1974 13 p refs In JAPANESE; ENGLISH summary
(NAL-TR-361) Avail: NTIS HC $4.00

An experimental investigation on the transonic flutter characteristics of the cantilever swept-back wing was conducted in a transonic blow-down wind tunnel for flutter testing at Mach numbers from 0.756 to 0.978. The wing models used in the investigation have a swept-back angle of 20 deg at the quater-chord line, panel aspect ratio and taper ratio of 4.0 and 0.4, respectively, utilize the airfoil section of NACA 65A 0012, and include two kinds of configuration of the models, i.e., the clean wing and the wing with a mass of engine-pod shape. The boundaries of flutter-density and experimental flutter-speed coefficients are characterized by the minimum values at certain interim Mach numbers investigated. Also, the results obtained were compared with the previous results of flat-plate wings, and it was found that the wing with airfoil section had a stabilizing effect except in the case of the wing with a mass for high Mach number tested. Author

N74-34481*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FLIGHT-PATH AND AIRSPEED CONTROL DURING LANDING APPROACH FOR POWERED-LIFT AIRCRAFT
James A. Franklin and Robert C. Innis Washington Oct. 1974 63 p refs
(NASA-TN-D-7791; A-5389) Avail: NTIS HC $3.75 CSCL 01B

Manual control of flight path and airspeed during landing approach has been investigated for powered-lift transport aircraft. An analysis was conducted to identify the behavior of the aircraft which would be potentially significant to the pilot controlling flight path and airspeed during the approach. The response characteristics found to describe the aircraft behavior were (1) the initial flight-path response and flight-path overshoot for a step change in thrust, (2) the steady-state coupling of flight path and airspeed for a step change in thrust, and (3) the sensitivity of airspeed to changes in pitch attitude. The significance of these response characteristics was evaluated by pilots on a large-motion, ground-based simulator at Ames Research Center. Coupling between flight path and airspeed was considered by the pilot to be the dominant influence on handling qualities for the approach task. Results are compared with data obtained from flight tests of three existing powered-lift V/STOL aircraft. Author

N74-34482*# Lockheed-Georgia Co., Marietta.
NON-ENGINE AERODYNAMIC NOISE INVESTIGATION OF A LARGE AIRCRAFT Final Report
John S. Gibson Washington NASA Oct. 1974 56 p refs
(Contract NAS1-12443)
(NASA-CR-2378) Avail: NTIS HC $3.75 CSCL 01C

A series of flyover noise measurements have been accomplished utilizing a large jet transport aircraft with engine power reduced to flight idle. It was determined that the aerodynamic (nonengine) noise levels did occur in the general range that had been predicted by using small aircraft (up to 17,690 kg gross weight) prediction techniques. The test procedures used are presented along with discussions of the effects of aerodynamic configuration on the radiated noise, identification of noise sources, and predicted aerodynamic noise as compared with measuremets. Author

N74-34483*# Washington Univ., St. Louis, Mo. Dept. of Mechanical and Aerospace Engineering.
METHODS STUDIES TOWARD SIMPLIFIED ROTOR-BODY DYNAMICS, PART 1 First Yearly Report
K. H. Hohenemser and S. K. Yin Jun. 1974 63 p refs
(Contract NAS2-7613)
(NASA-CR-137570) Avail: NTIS HC $6.25 CSCL 01B

This report is directed to the problem of developing an adequate but not overly complex linear flight dynamics analytical

model of a rotorcraft to study stability, control, gust and random turbulence responses. Since the conventional flight dynamics analysis using quasisteady rotor derivatives is adequate for the long period modes like the phugoid mode, only short time responses are considered here, where rotor-body coupling is of importance. Thus the body motion consists of pitch, roll and vertical motion, omitting linear longitudinal and lateral and yaw perturbations. Five analytical models of varying degree of sophistication are applied to a hypothetical hingeless compound helicopter operating up to .8 rotor advance ratio. Stability and response data are obtained for the basic helicopter and for the vehicle with two simple control feedback systems. Author

N74-34484*# Washington Univ., St. Louis, Mo. Dept. of Mechanical and Aerospace Engineering.
COMPUTER EXPERIMENTS IN PREPARATION OF SYSTEM IDENTIFICATION FROM TRANSIENT ROTOR MODEL TESTS, PART 2 First Yearly Report
K. H. Hohenemser and S. K. Yin Jun. 1974 60 p refs
(Contract NAS2-7613)
(NASA-CR-137571) Avail: NTIS HC $6.00 CSCL 01B

System identification methods which can extract model rotor paramenters with reasonable accuracy from noise polluted blade flapping transient measurements were developed. Usually parameter identification requires data on the state variables, that is on deflections and on rate of deflections. The small size of rotor models makes it, however, difficult to measure more than the blade flapping deflections. For the computer experiments it was, therefore, assumed that only noisy deflection measurements are available. Parameter identifications were performed for one and two unknown parameters. Both rotating coordinates and multiblade coordinates were used. It was found that data processing with a digital filter allowed by numerical differentiation a sufficiently accurate determination of the rates of deflection and of the accelerations to obtain reasonable parameter estimates with a simple linear estimator. Author

N74-34485*# Washington Univ., St. Louis, Mo. Dept. of Mechanical and Aerospace Engineering.
EXPERIMENTS WITH A FOUR-BLADED CYCLIC PITCH STIRRING MODEL ROTOR, PART 3 First Yearly Report
K. H. Hohenemser and S. T. Crews Jun. 1974 128 p refs
(Contract NAS2-7613)
(NASA-CR-137572) Avail: NTIS HC $9.50 CSCL 01B

The experimental work with the 2-bladed 16-inch diameter model rotor has been continued with a 4-bladed 16.5 inch diameter rotor capable of progressing and regressing cyclic pitch excitation (cyclic pitch stirring). Advance ratios of 0, .19 and .38 were tested at rotor speeds corresponding to non-dimensional blade natural frequencies of 1:14 and 1.19. The results are presented in the form of the first 5 Fourier components of the periodic response modulating function which for a periodic system takes the place of the complex response amplitude ratio of a constant system. In addition, the first and second harmonics of the trim response are presented. The test data are compared to analytical data without rotor wake and to the test data obtained earlier with the two-bladed rotor model of half the blade solidity ratio. Author

N74-34486*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
MEASUREMENTS OF SONIC BOOMS GENERATED BY AN AIRPLANE FLYING AT MACH 3.5 AND 4.8
Karen S. Green and Terrill W. Putnam Washington Oct. 1974 24 p refs
(NASA-TM-X-3126; H-838) Avail: NTIS HC $3.00 CSCL 20A

Sonic booms generated by the X-15 airplane flying at Mach numbers of 3.5 and 4.8 were measured. The experimental results agreed within 12 percent with results obtained from theoretical methods. No unusual phenomena related to overpressure were encountered. Scaled data from the X-15 airplane for Mach 4.8 agreed with data for an SR-71 airplane operating at lower Mach numbers and similar altitudes. The simple technique used to scale the data on the basis of airplane lift was satisfactory for comparing X-15 and SR-71 sonic boom signatures. Author

N74-34487*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPERIMENTAL INVESTIGATION OF THE BRAKING AND CORNERING CHARACTERISTICS OF 30 X 11.5-14.5, TYPE 8, AIRCRAFT TIRES WITH DIFFERENT TREAD PATTERNS
Robert C. Dreher and John A. Tanner Washington Oct. 1974 24 p refs
(NASA-TN-D-7743; L-9687) Avail: NTIS HC $3.00 CSCL 01C

An investigation was conducted at the aircraft landing loads and traction facility to study the braking and cornering characteristics, including the drag-force and cornering-force friction coefficients, of 30 by 11.5-14.5, type VIII aircraft tires with five different tread patterns. Test data were obtained on dry, damp, and flooded runway surfaces over a range of yaw angles from 0 deg to 12 deg at ground speeds from 5 knots to 100 knots. The results of this investigation indicate that a tread pattern consisting of transverse cuts across the entire width of the tread slightly improved the tire traction performance on wet surfaces. The braking and cornering capability of the tires was degraded by thin-film lubrication and tire hydroplaning effects on the wet runway surfaces. The braking capability of the tires decreased when the yaw angle was increased. Author

N74-34488# Advisory Group for Aerospace Research and Development, Paris (France).
TECHNICAL EVALUATION REPORT ON THE AGARD SPECIALISTS MEETING ON DESIGN AGAINST FATIGUE
J. B. DeJong (Natl. Aerospace Lab., Amsterdam) Aug. 1974 16 p
(AGARD-AR-71) Avail: NTIS HC $4.00

Properties and performance data on fighter aircraft fatigue are examined. Damage tolerance associated with structural safety and inspectability is considered, along with flight load monitoring. J.A.M.

N74-34489*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ROTORCRAFT DYNAMICS
Washington 1974 370 p refs Conf. held at Moffett Field Calif., 13-15 Feb. 1974; Sponsored in part by the American Helicopter Soc.
(NASA-SP-352) Avail: NTIS HC $8.00

The dynamic structural analysis of rotary winged aircraft is reported, considering helicopter vibration and loads. For individual titles, see N74-34490 through N74-34515.

N74-34490* Army Air Mobility Research and Development Lab., Moffett Field, Calif.
HINGELESS ROTOR FREQUENCY RESPONSE WITH UNSTEADY INFLOW
David A. Peters *In* NASA. Ames Res. Center Rotorcraft Dyn. 1974 p 1-12 refs (For availability see N74-34489 24-02)
CSCL 01B

Hingeless rotor frequency response calculations are obtained by applying a generalized harmonic balance to the elastic blade flapping equations. Nonuniform, unsteady induced flow effects are included by assuming a simple three-degree-of-freedom description of the rotor wake. Results obtained by using various models of elastic blade bending and induced flow are compared with experimental data obtained from a 7.5-ft diameter wind tunnel model at advance ratios from 0.0 to 0.6. It is shown that the blade elasticity and nonuniform, unsteady induced flow can have a significant effect on the transient response characteristics of rotor systems. Author

N74-34491* United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft Div.
DYNAMIC STALL MODELING AND CORRELATION WITH EXPERIMENTAL DATA ON AIRFOILS AND ROTORS
R. G. Carlson, R. H. Blackwell, G. L. Commerford, and P. H. Mirick (Army Air Mobility R and D Lab., Fort Eustis, Va.) *In* NASA. Ames Res. Center Rotorcraft Dyn. 1974 p 13-23 refs (For availability see N74-34489 24-02)
(Contract DAAJ02-72-C-0105)
CSCL 01B

Two methods for modeling dynamic stall have been developed.

The alpha, A, B method generates lift and pitching moments as functions of angle of attack and its first two time derivatives. The coefficients are derived from experimental data for oscillating airfoils. The Time Delay Method generates the coefficients from steady state airfoil characteristics and an associated time delay in stall beyond the steady state stall angle. Correlation with three types of test data shows that the alpha, A, B method is somewhat better for use in predicting helicopter rotor response in forward flight. Correlation with lift and moment hysteresis loops generated for oscillating airfoils was good for both models. Author

N74-34492* Washington Univ., St. Louis, Mo.
COMPUTER EXPERIMENTS ON PERIODIC SYSTEMS IDENTIFICATION USING ROTOR BLADE TRANSIENT FLAPPING-TORSION RESPONSES AT HIGH ADVANCE RATIO
K. H. Hohenemser and D. A. Prelewicz *In* NASA. Ames Res. Center Rotorcraft Dyn. 1974 p 25-34 refs (For availability see N74-34489 24-02)
CSCL 01B

Systems identification methods have recently been applied to rotorcraft to estimate stability derivatives from transient flight control response data. While these applications assumed a linear constant coefficient representation of the rotorcraft, the computer experiments described in this paper used transient responses in flap-bending and torsion of a rotor blade at high advance ratio which is a rapidly time varying periodic system. Author

N74-34493* United Aircraft Corp., East Hartford, Conn. Research Labs.
DYNAMIC ANALYSIS OF MULTI-DEGREE-OF-FREEDOM SYSTEMS USING PHASING MATRICES
Richard L. Bielawa *In* NASA. Ames Res. Center Rotorcraft Dyn. 1974 p 35-43 refs (For availability see N74-34489 24-02)
CSCL 01B

A mathematical technique is presented for improved analysis of a wide class of dynamic and aeroelastic systems characterized by several degrees-of-freedom. The technique enables greater utilization of the usual eigensolution obtained from the system dynamic equations by systematizing the identification of destabilizing and/or stiffening forces. Included, as illustrative examples of the use of the technique, are analyses of a helicopter rotor blade for bending-torsion divergence and flutter and for pitch-lag/flap instability. Author

N74-34494* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SOME APPROXIMATIONS TO THE FLAPPING STABILITY OF HELICOPTER ROTORS
James C. Biggers *In* Its Rotorcraft Dyn. 1974 p 45-53 refs (For availability see N74-34489 24-02)
CSCL 01B

The flapping equation for a helicopter in forward flight are reported which have coefficients that are periodic in time, and this effect complicates the calculation of stability. A constant coefficient approximation which will allow the use of all the well known methods for analyzing constant coefficient equations are presented. The flapping equation is first transformed into the nonrotating coordinate frame, where some of the periodic coefficients are transformed into constant terms. The constant coefficient approximation is then made by using time averaged coefficients in the nonrotating frame. Stability calculations based on the approximation are compared to results from a theory which correctly includes all of the periodicity. The comparison indicates that the approximation is reasonably accurate at advance ratios up to 0.5. Author

N74-34495* California Univ., Los Angeles. Dept. of Mechanics and Structures.
FLAP-LAG DYNAMICS OF HINGELESS HELICOPTER BLADES AT MODERATE AND HIGH ADVANCE RATIOS
P. Friedman and L. J. Silverthorn *In* NASA. Ames Res. Center Rotorcraft Dyn. 1974 p 55-66 refs (For availability see N74-34489 24-02)
CSCL 01B

Equations for large amplitude coupled flaplag motion of a hingeless elastic helicopter blade in forward flight are derived. Only a torsionally rigid blade exicted by quasi-steady aerodynamic loads is considered. The effects of reversed flow together with some new terms due to forward flight are included. Using Galerkin's method the spatial dependence is eliminated and the equations are linearized about a suitable equilibrium position. The resulting system of equations is solved using multivariable Floquet-Liapunov theory, and the transition matrix at the end of the period is evaluated by two separate methods. Results illustrating the effects of forward flight and various important blade parameters on the stability boundaries are presented. Author

N74-34496* United Aircraft Corp., Stratford, Conn.
CORRELATION OF FINITE-ELEMENT STRUCTURAL DYNAMIC ANALYSIS WITH MEASURED FREE VIBRATION CHARACTERISTICS FOR A FULL-SCALE HELICOPTER FUSELAGE **c32**
Irwin J. Kenigsberg, Michael W. Dean, and Ray Malatino (Naval Air Systems Command) *In* NASA. Ames Res. Center Rotorcraft Dyn. 1974 p 67-80 refs (For availability see N74-34489 24-02)
CSCL 20K

The correlation achieved with each program provides the material for a discussion of modeling techniques developed for general application to finite-element dynamic analyses of helicopter airframes. Included are the selection of static and dynamic degrees of freedom, cockpit structural modeling, and the extent of flexible-frame modeling in the transmission support region and in the vicinity of large cut-outs. The sensitivity of predicted results to these modeling assumptions are discussed. Both the Sikorsky Finite-Element Airframe Vibration analysis Program (FRAN/Vibration Analysis) and the NASA Structural Analysis Program (NASTRAN) have been correlated with data taken in full-scale vibration tests of a modified CH-53A helicopter. Author

N74-34497* Boeing Vertol Co., Philadelphia, Pa.
COUPLED ROTOR/AIRFRAME VIBRATION PREDICTION METHODS
J. A. Staley and J. J. Sciarra *In* NASA. Ames Res. Center Rotorcraft Dyn. 1974 p 81-90 refs (For availability see N74-34489 24-02)
(Contract DAHC04-71-C-0048)
CSCL 01B

The problems of airframe structural dynamic representation and effects of coupled rotor/airframe vibration are discussed. Several finite element computer programs (including NASTRAN) and methods for idealization and computation of airframe natural modes and frequencies and forced response are reviewed. Methods for obtaining a simultaneous rotor and fuselage vibratory response, determining effectiveness of vibration control devices, and energy methods for structural optimization are also discussed. Application of these methods is shown for the vibration prediction of the model 347 helicopter. Author

N74-34498* United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft Div.
HELICOPTER GUST RESPONSE CHARACTERISTICS INCLUDING UNSTEADY AERODYNAMIC STALL EFFECTS
Peter J. Arcidiacono, Russell R. Bergquist, and W. T. Alexander, Jr. (Army Air Mobility R and D Lab., Fort Eustis, Va.) *In* NASA. Ames Res. Center Rotorcraft Dyn. 1974 p 91-100 refs (For availability see N74-34489 24-02)
CSCL 01B

The results of an analytical study to evaluate the general response characteristics of a helicopter subjected to various types of discrete gust encounters are presented. The analysis employed was a nonlinear coupled, multi-blade rotorfuselage analysis including the effects of blade flexibility and unsteady aerodynamic stall. Only the controls-fixed response of the basic aircraft without any aircraft stability augmentation was considered. A discussion of the basic differences between gust sensitivity of fixed and rotary wing aircraft is presented. The effects of several rotor configuration and aircraft operating parameters on initial gust-induced load factor and blade vibratory stress and pushrod loads are discussed. Author

N74-34499* Kaman Aerospace Corp., Bloomfield, Conn.
APPLICATION OF ANTIRESONANCE THEORY TO HELICOPTERS c32
Felton D. Bartlett, Jr. and William G. Flannelly *In* NASA. Ames Res. Center Rotorcraft Dyn. 1974 p 101-106 refs (For availability see N74-34489 24-02)
CSCL 20K

Antiresonance theory is the principle underlying nonresonant nodes in a structure, and covers both nonresonant nodes occurring naturally and those introduced by devices such as dynamic absorbers and antiresonant isolators. The dynamic antiresonant vibration isolator (DAVI) and the nodale module are examples of the applications of transfer antiresonances. It is shown that antiresonances are eigenvalues, and that they can be determined by matrix iteration. Applications of antiresonance theory to helicopter engineering problems, using the antiresonant eigenvalue equation are suggested. Author

N74-34500* Bell Helicopter Co., Fort Worth, Tex.
THE EFFECT OF CYCLIC FEATHERING MOTIONS ON DYNAMIC ROTOR LOADS
Keith W. Harvey *In* NASA. Ames Res. Center Rotorcraft Dyn. 1974 p 107-114 refs (For availability see N74-34489 24-02)
CSCL 01B

The dynamic loads of a helicopter rotor in forward flight are influenced significantly by the geometric pitch angles between the structural axes of the hub and blade sections and the plane of rotation. The analytical study presented includes elastic coupling between inplane and out-of-plane deflections as a function of geometric pitch between the plane of rotation and the principal axes of inertia of each blade. The numerical evaluation is based on a transient analysis using lumped masses and elastic substructure techniques. A comparison of cases with and without cyclic feathering motion shows the effect on computed dynamic rotor loads. Author

N74-34501* Boeing Vertol Co., Philadelphia, Pa.
CONTROL LOAD ENVELOPE SHAPING BY LIVE TWIST
F. J. Tarzanin, Jr. and P. H. Mirick (Army Air Mobility R and D Lab., Fort Eustis, Va.) *In* NASA. Ames Res. Center Rotorcraft Dyn. 1974 p 115-125 refs (For availability see N74-34489 24-02)
(Contract DAAJ02-72-C-0093)
CSCL 01B

Rotor control systems experience a rapid load growth resulting from retreating blade stall during flight conditions of high blade loading or airspeeds. An investigation was undertaken to determine the effect of changing blade torsional properties over the rotor flight envelope. The results of this study show that reducing the blade stiffness to introduce more blade live twist significantly reduces the large retreating blade control loads, while expanding the flight envelope and reducing retreating blade stall loads. Author

N74-34502* Texas A&M Univ., College Station. Dept. of Aerospace Engineering.
APPLICATION TO ROTARY WINGS OF A SIMPLIFIED AERODYNAMIC LIFTING SURFACE THEORY FOR UNSTEADY COMPRESSIBLE FLOW
B. M. Rao and W. P. Jones *In* NASA. Ames Res. Center Rotorcraft Dyn. 1974 p 127-135 refs Sponsored in part by AROD (For availability see N74-34489 24-02)
CSCL 01A

A general method of predicting airloads is applied to helicopter rotor blades on a full three-dimensional basis using the general theory developed for a rotor blade at the psi = pi/2 position where flutter is most likely to occur. Calculations of aerodynamic coefficients for use in flutter analysis are made for forward and hovering flight with low inflow. The results are compared with values given by two-dimensional strip theory for a rigid rotor hinged at its root. The comparisons indicate the inadequacies of strip theory for airload prediction. One important conclusion drawn from this study is that the curved wake has a substantial effect on the chordwise load distribution. Author

N74-34503* Boeing Vertol Co., Philadelphia, Pa.
ROTOR AEROELASTIC STABILITY COUPLED WITH HELICOPTER BODY MOTION
Wen-Liu Miao and Helmut B. Huber (Messerschmitt-Boelkov-Blohm G.m.b.H., Ottobrunn, West Germany) *In* NASA. Ames Res. Center Rotorcraft Dyn. 1974 p 137-146 refs (For availability see N74-34489 24-02)
CSCL 01B

A 5.5-foot-diameter, soft-in-plane, hingeless-rotor system was tested on a gimbal which allowed the helicopter rigid-body pitch and roll motions. Coupled rotor/airframe aeroelastic stability boundaries were explored and the modal damping ratios were measured. The time histories were correlated with analysis with excellent agreement. The effects of forward speed and some rotor design parameters on the coupled rotor/airframe stability were explored both by model and analysis. Some physical insights into the coupled stability phenomenon are suggested. Author

N74-34504* Army Air Mobility Research and Development Lab., Hampton, Va.
AN APPLICATION OF FLOQUET THEORY TO PREDICTION OF MECHANICAL INSTABILITY
C. E. Hammond *In* NASA. Ames Res. Center Rotorcraft Dyn. 1974 p 147-158 refs (For availability see N74-34489 24-02)
CSCL 01B

The problem of helicopter mechanical instability is considered for the case where one blade damper is inoperative, and it is shown that if the hub is considered to be nonisotropic, the equations of motion have periodic coefficients which cannot be eliminated. The Floquet transition matrix method is shown to be an effective way of dealing with the nonisotropic hub and nonisotropic rotor situation. Time history calculations are examined and shown to be inferior to the Floquet technique for determining system stability. It is shown that instabilities which occur when one blade damper is inoperative may consist of nearly pure blade motion or they may be similar to the classical mechanical instability. Author

N74-34505* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THEORY AND COMPARISON WITH TESTS OF TWO FULL-SCALE PROPROTORS c01
Wayne Johnson (Army Air Mobility R and D Lab., Moffett Field, Calif.) *In* Its Rotorcraft Dyn. 1974 p 159-169 refs (For availability see N74-34489 24-02)
CSCL 01A

A nine degrees-of-freedom theoretical model was developed for investigations of the dynamics of a proprotor operating in high inflow axial flight on a cantilever wing. The theory is described, and the results of the analysis are presented for two proprotor configurations: a gimballed, stiff-inplane rotor, and a hingeless, soft-inplane rotor. The influence of various elements of the theory are discussed, including the modeling used for the blade and wing aerodynamics, and the influence of the rotor lag degree of freedom. The results from full-scale tests of the two proprotors are presented and compared with the theoretical results. Author

N74-34506* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPERIMENTAL AND ANALYTICAL STUDIES IN TILT-ROTOR AEROELASTICITY c01
Raymond G. Kvaternik *In* Its Rotorcraft Dyn. 1974 p 171-184 refs (For availability see N74-34489 24-02)
CSCL 01A

An overview of an experimental and analytical research program underway for studying the aeroelastic and dynamic characteristics of tilt-rotor VTOL aircraft is presented. Selected results from several investigations of scaled models in the transonic dynamics tunnel, as well as some results from a test of a flight-worthy proprotor in the full-scale wind tunnel are shown and discussed with a view toward delineating various aspects of dynamic behavior peculiar to proprotor aircraft. Included are such items as proprotor/pylon stability, whirl flutter, gust response, and blade flapping. Theoretical predictions are shown to be in agreement with the measured stability and response behavior. Author

N74-34507* Lockheed-California Co., Burbank.
COMPARISON OF FLIGHT DATA AND ANALYSIS FOR HINGELESS ROTOR REGRESSIVE INPLANE MODE

STABILITY
W. D. Anderson and J. F. Johnston *In* NASA. Ames Res. Center Rotorcraft Dyn. 1974 p 185-197 refs (For availability see N74-34489 24-02)
CSCL 01B

Analytical and experimental data obtained during the development of the AH-56A covering stability of the regressive inplane mode, including coupling with other modes such as body and rotor plunge are reported. Data were obtained on two distinctly different control systems; both gyro controlled, but one with feathering moment feedback and the other with direct flapping feedback. A review was made of analytical procedures employed in investigating the stability of this mode and a comparison was made of the analytical and experimental data. The effect of certain parameters including blade droop, sweep, delta 3, alpha 1, vehicle roll inertia, inplane frequency, and rpm and forward speed on the mode were also reviewed. It was shown that the stability of this mode is treatable by analysis and that adequate stability is achievable without recourse to auxiliary inplane damping devices. Author

N74-34508* Bell Helicopter Co., Fort Worth, Tex.
HUB MOMENT SPRINGS ON TWO-BLADED TEETERING ROTORS
Walter Sonneborn and Jing Yen *In* NASA. Ames Res. Center Rotorcraft Dyn. 1974 p 199-204 refs (For availability see N74-34489 24-02)
CSCL 01B

Two-bladed teetering rotors with elastic flapping hinge restraint are shown to be suitable for zero-g flight. The alternating moment component introduced into the fuselage by the hinge spring can be balanced about the aircraft center of gravity by alternating hub shears. Such shears can be produced in proper magnitude, frequency, and phase by additional underslinging of the hub and by judicious choice of the location of the first inplane cantilevered natural frequency. Trends of theoretical results agree with test results from a small scale model and a modified OH-58A helicopter. Author

N74-34509* Delaware Univ., Newark.
OPEN AND CLOSED LOOP STABILITY OF HINGELESS ROTOR HELICOPTER AIR AND GROUND RESONANCE c01
Maurice I. Young, David J. Bailey, and Murray S. Hirschbein *In* NASA. Ames Res. Center Rotorcraft Dyn. 1974 p 205-218 refs (For availability see N74-34489 24-02)
(Grant DA-ARO(D)-1-247-G112)
CSCL 01A

The air and ground resonance instabilities of hingeless rotor helicopters are examined on a relatively broad parametric basis including the effects of blade tuning, virtual hinge locations, and blade hysteresis damping, as well as size and scale effects in the gross weight range from 5,000 to 48,000 pounds. A special case of a 72,000 pound helicopter air resonance instability is also included. The study shows that nominal to moderate and readily achieved levels of blade inertial hysteresis damping in conjunction with a variety of tuning and/or feedback conditions are highly effective in dealing with these instabilities. Tip weights and reductions in pre-coning angles are also shown to be effective means for improving the air resonance instability. Author

N74-34510* Hughes Helicopters, Culver City, Calif.
VERTICAL-PLANE PENDULUM ABSORBERS FOR MINIMIZING HELICOPTER VIBRATORY LOADS
Kenneth B. Amer and James R. Neff *In* NASA. Ames Res. Center Rotorcraft Dyn. 1974 p 219-222 refs (For availability see N74-34489 24-02)
CSCL 01B

The use of pendulum dynamic absorbers mounted on the blade root and operating in the vertical plane to minimize helicopter vibratory loads was discussed. A qualitative description was given of the concept of the dynamic absorbers and some results of analytical studies showing the degree of reduction in vibratory loads attainable are presented. Operational experience of vertical plane dynamic absorbers on the OH-6A helicopter is also discussed. Author

N74-34511* Army Air Mobility Research and Development Lab., Fort Eustis, Va.
EVALUATION OF A STALL-FLUTTER SPRING-DAMPER PUSHROD IN THE ROTATING CONTROL SYSTEM OF A CH-54B HELICOPTER
William E. Nettles, William F. Paul (United Aircraft Corp., Stratford, Conn.), and David O. Adams (United Aircraft Corp., Stratford, Conn.) *In* NASA. Ames Res. Center Rotorcraft Dyn. 1974 p 223-232 refs (For availability see N74-34489 24-02)
CSCL 01B

Results of a design and flight test program conducted to define the effect of rotating pushrod damping on stall-flutter induced control loads are presented. The CH-54B helicopter was chosen as the test aircraft because it exhibited stall induced control loads. Damping was introduced into the CH-54B control system by replacing the standard pushrod with spring-damper assemblies. Design features of the spring-damper are described and the results of a dynamic analysis are shown which define the pushrod stiffness and damping requirements. Flight test measurements taken at 47,000 lb gross weight with and without the damper are presented. The results indicate that the spring-damper pushrods reduced high frequency, stall-induced rotating control loads by almost 50%. Fixed system control loads were reduced by 40%. Handling qualities in stall were unchanged, as expected. Author

N74-34512* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MULTICYCLIC JET-FLAP CONTROL FOR ALLEVIATION OF HELICOPTER BLADE STRESSES AND FUSELAGE VIBRATION
John L. McCloud, III and Marcel Kretz *In* Its Rotorcraft Dyn. 1974 p 233-238 refs (For availability see N74-34489 24-02)
CSCL 01B

Results of wind tunnel tests of a 12 meter-diameter-rotor utilizing multicyclic jet-flap control deflection are presented. Analyses of these results are shown, and experimental transfer functions are determined by which optimal control vectors are developed. These vectors are calculated to eliminate specific harmonic bending stresses, minimize rms levels (a measure of the peak-to-peak stresses), or minimize vertical vibratory loads that would be transmitted to the fuselage. Although the specific results and the ideal control vectors presented are for a specific jet-flap driven rotor, the method employed for the analyses is applicable to similar investigations. A discussion of possible alternative methods of multicyclic control by mechanical flaps or nonpropulsive jet-flaps is presented. Author

N74-34513* Kaman Aircraft Corp., Bloomfield, Conn.
IDENTIFICATION OF STRUCTURAL PARAMETERS FROM HELICOPTER DYNAMIC TEST DATA c32
Nicholas Giansante and William G. Flannelly *In* NASA. Ames Res. Center Rotorcraft Dyn. 1974 p 239-248 refs (For availability see N74-34489 24-02)
CSCL 20K

A method is presented for obtaining the mass, stiffness, and damping parameters of a linear mathematical model, having fewer degrees of freedom than the structure it represents, directly from dynamic response measurements on the actual helicopter without a priori knowledge of the physical characteristics of the fuselage. The only input information required in the formulation is the approximate natural frequency of each mode and mobility data measured proximate to these frequencies with sinusoidal force excitation applied at only one point on the vehicle. The practicality and numerical soundness of the theoretical development was demonstrated through a computer simulation of an experimental program. Author

N74-34514* Boeing Vertol Co., Philadelphia, Pa.
ENGINE/AIRFRAME INTERFACE DYNAMICS EXPERIENCE
C. Fredrickson *In* NASA. Ames Res. Center Rotorcraft Dyn. 1974 p 249-260 refs (For availability see N74-34489 24-02)
CSCL 01B

Problems of engine/drive system torsional stability, engine and output shaft critical speeds, and engine vibration at helicopter rotor order frequencies are discussed, and test data and analyses

presented. Also presented is a rotor/drive system dynamics problem not directly related to the engine. Author

N74-34515* Lockheed-California Co., Burbank.
HINGELESS ROTOR THEORY AND EXPERIMENT ON VIBRATION REDUCTION BY PERIODIC VARIATION OF CONVENTIONAL CONTROLS
G. J. Sissingh and R. E. Donham *In* NASA. Ames Res. Center Rotorcraft Dyn. 1974 p 261-277 refs (For availability see N74-34489 24-02)
CSCL 01B

The reduction of the n per rev. pitch-, roll- and vertical vibrations of an n-bladed rotor by n per rev. sinusoidal variations of the collective and cyclic controls is investigated. The numerical results presented refer to a four-bladed, 7.5-foot model and are based on frequency response tests conducted under an Army-sponsored research program. The following subjects are treated: extraction of the rotor transfer functions (.073R hub flapping and model thrust versus servo valve command, amplitude and phase), calculation of servo commands (volts) required to compensate .073R hub flapping (3P and 5P) and model thrust (4P), evaluation of the effect of the vibratory control inputs on blade loads, and theoretical prediction of the root flapbending moments generated by 0 to 5P perturbations of the feathering angle and rotor angle of attack. Five operating conditions are investigated covering advance ratios from approximately 0.2 to 0.85. The feasibility of vibration reduction by periodic variation on conventional controls is evaluated. Author

N74-34516# Office of the Assistant for Study Support, Kirtland AFB, N.Mex.
MODELS AND METHODOLOGY FOR LIFE CYCLE COST AND TEST AND EVALUATION ANALYSIS Final Report
Richard H. Anderson, Thomas E. Dixon, Robert F. Couch, Jr., and William H. Newhart, Jr. Jul. 1973 160 p refs
(AD-782182; OAS-TR-73-6) Avail: NTIS CSCL 01/3

This report documents various models and methodology which were developed during the course of some analytical studies on life cycle cost and test and evaluation. These studies were conducted by the Office of the Assistant for Study Support (OAS) at the request of DCS/Development Plans, Headquarters AFSC. The objectives of the study were to: Investigate the present methods of subsystem reliability specification and identify limitations associated with these methods; investigate new and innovative techniques for subsystem reliability management and identify benefits to be derived in terms of higher performance/lower costs; and, develop models and methodology applicable to life cycle cost and test and evaluation analyses. (Modified author abstract) GRA

N74-34517# Rockwell International Corp., Los Angeles, Calif. Aircraft Div.
FIGHTER TECHNOLOGY DEMONSTRATOR PRECURSOR ANALYSIS AND TEST. VOLUME 1: BASELINE DEVELOPMENT AND TECHNOLOGY IDENTIFICATION Final Report, May - Oct. 1973
Nov. 1973 277 p refs
(Contract F33615-73-C-3135; AF Proj. 1207)
(AD-783636; AFFDL-TR-73-112-Vol-1) Avail: NTIS CSCL 01/3

The development of a manned fighter technology demonstrator design, with potential for near-term in-flight evaluation of advanced technologies, is presented. To support the development of this precursor air vehicle, a prime purpose of the study was to establish design goals and criteria against which in-flight technology demonstration could be practically measured. An additional purpose of the study was to assess the usefulness of a selected number of additional technologies for inclusion in the baseline configuration. A final purpose was to conduct a wind tunnel test to provide supportive information of several advanced concepts. Wind tunnel test results showed increased induced life effects with increasing jet flap span and a significant canard contribution to high angle-of-attack directional stability. This latter effect is very important in allowing full use of increased angle-of-attack performance, since it suppresses post all gyration and spin tendencies. (Modified author abstract) GRA

N74-34518# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
AN EXPERIMENTAL AND ANALYTICAL STUDY OF SPECTRUM TRUNCATION EFFECTS
J. M. Potter Feb. 1974 27 p refs
(AD-778488/7; AFFDL-TR-73-117) Avail: NTIS HC $3.25 CSCL 01/3

The results and analysis of a series of tests designed to investigate the effects of load cycle truncation in a flight-by-flight sequence loading are presented. Conventional damage analyses were used to determine the load cycles that could be eliminated without significantly changing the structural life when compared to the full spectrum. A newly developed cumulative damage analysis, the sequence accountable fatigue analysis; was used to make independent predictions of the truncation. GRA

N74-34519# Bell Helicopter Co., Fort Worth, Tex.
R/M DATA ANALYSIS OF THE UH-1/AH-1 TAIL ROTOR SYSTEM Final Report
George E. Knudsen and Patricia V. Carr Apr. 1974 384 p
(Contract DAAJ02-72-C-0028; DA Proj. 1F1-62205-A-11)
(AD-782858; USAAMRDL-TR-74-11) Avail: NTIS CSCL 01/3

The report provides reliability, maintainability, and cost analysis of historical data reported on the UH-1/AH-1 tail rotor subsystems. The objectives of this analysis are to develop benchmark maintenance and logistic support data for the design of future helicopter anti-torque systems and to put into better perspective the cost of tail-rotor-system-associated mishaps. (Modified author abstract) GRA

N74-34520# Curtiss-Wright Corp., Wood-Ridge, N.J.
DESIGN AND DEVELOPMENT TESTING OF FREE PLANET TRANSMISSION CONCEPT Final Report, 26 Jun. 1972 - 31 Dec. 1973
Neil A. DeBruyne Apr. 1974 90 p refs
(Contract DAAJ02-72-C-0113)
(AD-782857; CW-WR-73-040.F; USAAMRDL-TR-74-27) Avail: NTIS CSCL 01/3

This report presents the results of an experimental program to demonstrate and evaluate the Curtiss-Wright free planet concept for power transmission. The program consisted of designing a 500-horsepower speed reducer to operate at 8000 rpm input speed and 19.2425 reduction ratio. This design was procured and evaluated. The evaluation consisted of static and dynamic evaluation as well as 50 hours of endurance testing at rated operating conditions. (Modified author abstract) GRA

N74-34521# Army Land Warfare Lab., Aberdeen Proving Ground, Md.
BALLOON MARKER Final Report
Benjamin F. Wood Jun. 1974 13 p refs
(AD-782107; LWL-TR-74-82) Avail: NTIS CSCL 15/7

A tethered balloon position marker was developed for use by troops operating in heavy forests. The system consists of a ten cubic-foot aerodynamically shaped balloon, two solid chemical hydrogen generator inflation cartridges, a strobe light for night time use, a tether line, and a carrying case. The system is an improved version of a system developed earlier which used a spherical balloon and a cylinder of compressed helium for inflation. The improved balloon shape provides better vertical flying qualities, and the hydrogen generator reduces weight. A battery with improved shelf life is used in the strobe light. An evaluation quantity of the marker systems was furnished to user units for evaluation; the results were not available for inclusion in the report. Author (GRA)

N74-34522# Arctec, Inc., Columbia, Md.
MODEL TESTS OF ARCTIC SEV OVER MODEL ICE
E. J. Lecourt and T. Kotras 1 Aug. 1974 84 p refs
(Contract N00600-74-C-0093; ARPA Order 2251)
(AD-782630; TR-0062-9) Avail: NTIS CSCL 01/3

The model test program for the Arctic SEV (Surface Effect Vehicles) consisted of two parts. The objective of the first part was to determine the resistance of an SEV operating over ice covered water. The second part of the test program was concerned with the problems associated with parking the Arctic SEV on the ice. Each part consisted of a series of model tests conducted

in the ARCTEC Ice Model Basin, Savage, Maryland, to empirically determine the desired relationships between the independent and dependent test variables. GRA

N74-34523# Lockheed-Georgia Co., Marietta.
ADVANCED METALLIC STRUCTURES: CARGO WING DESIGN FOR IMPROVED COST, WEIGHT, AND INTEGRITY Final Technical Report, Jul. 1972 - Jun. 1973
C. R. Brigham, R. E. Barrie, L. M. Atkinson, O. L. Freyre, and H. W. Stemme Jun. 1973 412 p refs
(Contract F33615-72-C-2165; AF Proj. 486U)
(AD-782258; LG73ER0126; AFFDL-TR-73-51) Avail: NTIS CSCL 01/3

With the current Air Force medium transport and tanker fleets rapidly approaching the end of their useful life, a requirement for their replacement is inevitable. Demonstration of innovative advanced structures concepts is required prior to production decisions in order to qualify these advances for new system acceptance. The long lead times required for the development and demonstration of advanced structures dictates that advanced development programs be initiated now to insure the availability of the various technologies when needed for anticipated future systems. This requirement has led to this advanced development program to develop improved aircraft structural designs for a cargo/tanker category aircraft. The C-141 inner wing box was used as the baseline for the preliminary design study phase of this development program. The major objective of this study was to develop advanced designs which would double the fatigue life endurance of the baseline, and which could be produced at lower cost and weight. (Modified author abstract) GRA

N74-34524# Army Air Mobility Research and Development Lab., Fort Eustis, Va. Eustis Directorate.
STREAMLINE CALCULATIONS USING XYZ POTENTIAL FLOW PROGRAM
James Gillespie, Jr. May 1974 24 p refs
(DA Proj. 1F1-62204-AA-41)
(AD-782955; USAAMRDL-TN-16) Avail: NTIS CSCL 01/3

Potential flow and boundary layer calculations have been performed on various helicopter fuselage configurations as part of an overall program to provide an analytical method to predict and subsequently reduce parasite drag. The boundary layer calculation uses the small crossflow assumption and requires a knowledge of the streamline divergence. The present method for calculating streamline divergence is not completely satisfactory. The XYZ potential flow program, developed by the Naval Ship Research and Development Center, appeared to have a more attractive streamline divergence calculation. Streamline divergence calculations using the XYZ program were validated on a cone, a sphere, and the HLH model. In addition, a potential flow calculation, using the XYZ program, was performed on a scale model of the Boeing Vertol Heavy Lift Helicopter (HLH), and the results agreed very well with wind tunnel test data. These results indicate that the XYZ potential flow program can be used to calculate the streamline divergence of advanced Army Helicopter fuselage configurations. Author (GRA)

N74-34525# Bell Helicopter Co., Fort Worth, Tex.
FLIGHT TEST OF A HINGELESS FLEXBEAM ROTOR SYSTEM Final Report
Charles W. Hughes and Rodney K. Wernicke Jun. 1974 213 p refs
(Contract DAAJ02-72-C-0036; DA Proj. 1F2-63211-D-157)
(AD-783393; BHC-TR-299-099-575; USAAMRDL-TR-74-38) Avail: NTIS CSCL 01/3

This report presents the results of flight tests of a stiff-in-plane flexbeam hingeless four-bladed main rotor, hereafter referred to as the Model 609. The tests were conducted on a modified UH-1 at gross weights from 10,000 to 14,000 pounds and at level-flight speeds up to 150 knots to evaluate performance, handling qualities, maneuverability, and load levels. The tests also evaluated a focused pylon system designed for isolating rotor vibrations. (Modified author abstract) GRA

N74-34526# Army Aviation Systems Command, St. Louis, Mo.
MAJOR ITEM SPECIAL STUDY (MISS), OH-6A TAIL ROTOR TRANSMISSION ASSEMBLY Interim Report, 1 Jan. 1964 - 1 Jul. 1973
Jul. 1974 22 p refs
(AD-782926; USAAVSCOM-TR-74-34) Avail: NTIS CSCL 01/3

The report is designed to illustrate cost savings which would result from specific efforts in the areas of product improvement in quality and design. For the purpose of this study the cost savings produced in the area of product improvement are based on total elimination of a certain failure mode or modes. Appropriate modes are chosen because of their proportion of the total removals or their proportion in combination with other similar modes. These eliminated removals are then assumed to follow the distribution of the remaining removal modes. The actual cost savings are determined from the increase in the mean time to removal based on the new removal distributions. The data used and methods involved are described. GRA

N74-34527# Bell Helicopter Co., Fort Worth, Tex.
ROTORCRAFT FLIGHT SIMULATION WITH AEROELASTIC REPRESENTATION. VOLUME 1: ENGINEER'S MANUAL Final Report
John M. Davis, Richard L. Bennett, and Barney L. Blankenship Jun. 1974 245 p refs
(Contract DAAJ02-72-C-0098)
(AD-782854; BHC-TR-299-099-813; USAAMRDL-TR-74-10A) Avail: NTIS CSCL 01/3

The report consists of three volumes and documents the current version in the C81 family of rotorcraft flight simulation programs developed by Bell Helicopter Company. This current version of the digital computer program is referred to as AGAJ73. This first volume, the Engineer's Manual, presents an overview of the computer program capabilities plus discussions for the background and development of the principal mathematical models in the program. The models discussed include those developed under the current contract as well as two previous contracts. (Modified author abstract) GRA

N74-34528# Bell Helicopter Co., Fort Worth, Tex.
ROTORCRAFT FLIGHTS SIMULATION WITH AEROELASTIC REPRESENTATION. VOLUME 2: USER'S MANUAL Final Report
John M. Davis Jun. 1974 372 p refs
(Contract DAAJ02-72-C-0098)
(AD-782756; BHC-299-099-814; USAAMRDL-TR-74-10B) Avail: NTIS CSCL 01/3

The report consists of three volumes and documents the current version in the C81 family of rotorcraft flight simulation programs developed by Bell Helicopter Company. This current version of the digital computer program is referred to as AGAJ73. This volume, The User's Manual, presents the detailed information necessary to use the computer program. Section 1 is a brief introduction. The specific input quantities and format are listed in Section 2 and discussed in Section 3. Section 4 describes the program's output format and Section 5 discusses program error messages. A set of sample data is included for reference purposes. (Modified author abstract) GRA

N74-34529# Defense Documentation Center, Alexandria, Va.
HUMAN FACTORS IN DESIGN AND CONTROL OF AIRCRAFT Report Bibliography, Jan. 1957 - Jan. 1974
Jul. 1974 339 p refs
(AD-782700; DDC-TAS-74-28) Avail: NTIS CSCL 01/3

The bibliography contains unclassified and unlimited citations which provide human engineering configurations dealing with location and arrangement of controls and displays in aircraft. It also includes pertinent information on the psychological and biomedical aspects of human performance in aviation training as well as in actual flight. Four computer-generated indexes are included. Author (GRA)

N74-34530# United Aircraft Corp., East Hartford, Conn. Research Labs.
EXPERIMENTAL INVESTIGATION OF THE EFFECTS OF HELICOPTER ROTOR DESIGN PARAMETERS ON FORWARD FLIGHT STALL CHARACTERISTICS Final Report, Jan. 1972 - Dec. 1973
E. D. Bellinger, W. P. Patrick, L. E. Greenwald, and A. J. Landgrebe Apr. 1974 143 p refs
(Contract DAAJ02-72-C-0030)

(AD-783440; UARL-M911292-23; USAAMRDL-TR-74-1) Avail: NTIS CSCL 01/3

An experimental investigation was conducted to determine the effects of number of blades, twist, aspect ratio, camber, taper ratio, and torsional frequency on helicopter rotor stall characteristics in forward flight. The tests were conducted in the low-speed UARL 4- x 6-ft wind tunnel with 4.7-ft-diameter model rotors having flanping articulation. Stall conditions were approached by means of increasing rotor shaft angle at fixed collective pitch. Torsional frequency was varied by using a special blade root flexure which would produce the required rigid blade torsional frequencies. Rotor performance, blade response, and boundary layer separation data were acquired to determine the occurrence and extent of blade stall. (Modified author abstract) GRA

N74-34531# Air Force Materials Lab., Wright-Patterson AFB, Ohio.

CONSTRAINED LAYER TREATMENTS FOR NOISE CONTROL IN A HELICOPTER Final Report, Sep. - Dec. 1972

David I. G. Jones Mar. 1974 53 p refs

(AF Proj. 7351)

(AD-783234; AFML-TR-73-305) Avail: NTIS CSCL 01C

The report describes some of the results of an investigation to evaluate the effect of constrained layer damping treatments on cabin noise levels in an HH-53C helicopter. Vibration and noise levels were measured for various flight conditions, including hover, forward flight and banked, and in each case it was observed that the damping treatment reduced vibration and noise levels in certain frequency bands within which natural modes of vibration were strongly excited. Ground vibration tests under artificial excitation and laboratory vibration tests on simpler but related structures were also conducted to further understand the phenomena involved and to develop appropriate damping treatments for broad temperature range noise control applications. Author (GRA)

N74-34532# Clemson Univ., S.C. Dept. of Zoology.

BIOLOGICAL ASPECTS OF THE BIRD/AIRCRAFT COLLISION PROBLEM Final Report

Sidney A. Gauthreaux, Jr. May 1974 536 p refs Conf. held at Clemson, S. C., 5-7 Feb. 1974

(Grant AF-AFOSR-2534-73; AF Proj. 9777)

(AD-783314; AFOSR-74-1240TR) Avail: NTIS CSCL 06/3

A conference on biological aspects of the bird/aircraft collision problem was held at Clemson University, South Carolina, February 5-7, 1974. Twenty-six papers were presented and are compiled in this proceedings. The sessions were concerned with identification and magnitude of the problem, methodologies and techniques available and proposed which would be useful in solution of the problem and future research needs, priorities, and program administration. Author (GRA)

N74-34533# General Electric Co., Wilmington, Mass. Aerospace Instruments and Products Support Dept.

INTEGRATED ENGINE INSTRUMENT SYSTEM, PHASE 3, VOLUME 2 Final Technical Report, 29 Aug. 1972 - 30 Nov. 1973

R. L. Skovholt, D. E. Berglund, W. A. Doerle, W. R. Hiatt, F. P. Johnson, and H. L. McManus, Jr. Dec. 1973 228 p refs

(Contract N62269-73-C-0135)

(AD-783684; DF73AEE189-Vol-2) Avail: NTIS CSCL 01/3

Volume two of a two-part report continues the discussion of a computer driven display and processing instrumentation system for monitoring an aircraft engine's conditions in response to anticipated needs in the 1980-85 time frame. Some of the topics are hardware components, measuring and recording instruments, data processing systems, computer memory requirements, reliability and maintainability, software elements, display hardware, mechanical features, display engineering, dynamic and static evaluations, aircraft performance curves, modifications, automation, energy management, conclusions, and recommendations. GRA

N74-34534# Army Foreign Science and Technology Center, Charlottesville, Va.

REFERENCE MANUAL ON AVIATION MATERIALS

Victor Georgievich Aleksandrov Nov. 1973 196 p Transl. into ENGLISH of the monograph "Spranochnik po Aviagtionnym Materialam" Moscow, 1972 196 p

(AD-783739; FSTC-HT-23-1827-73) Avail: NTIS CSCL 01/3

Operation, servicing and repair of aviation equipment involves the use of various materials, working liquids, compressed gases and other substances. Their correct use makes possible an improved level of technical operation, an increased time period for service and improved reliability of aviation equipment. The book gives the physical, chemical and mechanical properties of steel, nonferrous alloys on a nickel base and on a base of hard-to-melt metals and plastics and ceramic metals which operate in washing liquids, fuel and lubricating materials etc. When using various materials it is necessary to take into account the actual operating conditions, that is, the character of load, temperature, the composition and properties of exterior media, altitude and load capacity of aircraft. Therefore, this handbook presents not only numerical data which characterize the various materials, but also recommendations on technological use and rational utilization during operation, servicing and repair of aviation equipment. GRA

N74-34535# Army Foreign Science and Technology Center, Charlottesville, Va.

AIRCRAFT GLASS FLAW DETECTION

V. Lopukhovskii 29 May 1974 4 p Transl. into ENGLISH from Aviatsiya i Kosmonavtika (Moscow), no. 4, 1973 27 p

(AD-783736; FSTC-HT-23-1826-73) Avail: NTIS CSCL 01/3

The author describes an instrument kit proposed by aviators. Transparent polymer materials have enjoyed wide application in aviation as aircraft cockpit windows and for other purposes. Articles made of polymer materials must be evaluated for further operational suitability when defects appear and during prevention maintenance and repair. The kit serves this purpose. GRA

N74-34536# Winzen Research, Inc., Minneapolis, Minn.

CRITERIA FOR CONTROLLING VERTICAL MOTION OF STRATOSPHERIC BALLOONS Final Report, 12 Apr. 1973 - 23 Apr. 1974

Jean R. Nelson 23 Apr. 1974 24 p

(Contract N00014-73-C-0382; NR Proj. 211-171)

(AD-783938; WRI-1300) Avail: NTIS CSCL 01/2

This report analyzes a number of balloon flights to determine empirical constants for the equation developed by the University of Minnesota. A computer program RISERATE was developed to accept flight data for the values in the percent lift equation shown and solve simultaneous equations for values of the empirical constants C1 and C2. These average values for balloons up to 20 million cubic feet volume were: C sub 1 equals .000378 and C sub 2 equals 4.63 times 10 to the 7th power. (Modified author abstract) GRA

N74-34537# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.

ANALYSIS OF PREDICTED AIRCRAFT WAKE VORTEX TRANSPORT AND COMPARISON WITH EXPERIMENT. VOLUME 2: APPENDIXES Final Report, 2 Apr. - 2 Dec. 1973

M. R. Brashears, N. A. Logan, S. J. Robertson, K. R. Shrider, and C. D. Walters Apr. 1974 233 p

(Contract DOT-TSC-593)

(AD-783665; TSC-FAA-74-7-Vol-2; FAA-RD-74-74-II) Avail: NTIS CSCL 01/1

Contents: Summary of aircraft flybys; Probable stability conditions prevalent during selected NAFEC flybys at Atlantic City, N.J.; Description of output plots of wake vortex transport computer program; Description of input requirements for Lockheed wake vortex transport computer program; Summary of line printer output of Lockheed wake vortex transport computer program; Flow charts for Lockheed wake vortex transport computer program; Summary of predicted wake vortex tracks and comparison with experiment; Report of inventions. GRA

N74-34538# Sanders Associates, Inc., Nashua, N.H.

TACTILE DISPLAY FOR AIRCRAFT CONTROL Semiannual Technical Report, 1 Jan. - 30 Jun. 1974

Don H. Rosa, Richard A. Sanneman, William H. Levison (Bolt, Beranek and Newman, Inc., Cambridge, Mass.), and Jeffrey E.

Berliner (Bolt, Beranek and Newman, Inc., Cambridge, Mass.) 30 Jun. 1974 94 p refs
(Contract N00014-73-C-0031; ARPA Order 2108; NR Proj. 196-123)
(AD-783690) Avail: NTIS CSCL 01/4

The program was directed towards the development of tactile displays for flight control. The results of the first phase of this program have been reported in the August 73 Final Report (AD-767 763). The report presents a description of an improved tactile display system and its evaluation as a one and two axis error display instrument during a series of manual tracking experiments. Both electrotactors and vibrotactors arrays were used. These experiments were run to obtain modeling data to predict the display performance during the forthcoming F-4 simulator evaluation phase of the program. The tracking error scores for the new tactile display are better than for the initial system. Of the four subjects employed during these tests, two preferred the electrotactor array because it provides a more clearly perceptable haptic display. (Modified author abstract) GRA

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines, hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; Nuclear Engineering; and 28 Propulsion Systems.

N74-34539*# Gould, Inc., Mendota Heights, Minn. Energy Research.
LONG LIFE, RECHARGEABLE NICKEL-ZINC BATTERY Final Report
E. Luksha Sep. 1974 90 p refs
(Contract NAS3-16809)
(NASA-CR-134658; Gould-742-031) Avail: NTIS HC $7.50 CSCL 10C

A production version of the inorganic separator was evaluated for improving the life of the nickel-zinc system. Nickel-zinc cells (7-10 Ah capacities) of different electrode separator configurations were constructed and tested. The nickel-zinc cells using the inorganic separator encasing the zinc electrode, the nickel electrode, or both electrodes had shorter lives than cells using Visking and cellophane separation. Cells with the inorganic separation all fell below 70% of their theoretical capacity within 30 cycles, but the cells constructed with organic separation required 80 cycles. Failure of the cells using the ceramic separator was irreversible capacity degradation due to zinc loss through cracks developed in the inorganic separator. Zinc loss through the separator was minimized with the use of combinations of the inorganic separator with Visking and cellophane. Cells using the combined separation operated 130 duty cycles before degrading to 70% of their theoretical capacity. Author

N74-34540*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A BRIEF SUMMARY OF THE ATTEMPTS TO DEVELOP LARGE WIND-ELECTRIC GENERATING SYSTEMS IN THE US
Joseph M. Savino 1974 17 p refs Presented at Wind Energy Conf., Stockholm, 29-30 Aug. 1974; sponsored by Swedish Board for Tech. Develop.
(NASA-TM-X-71605; E-8088) Avail: NTIS HC $3.00 CSCL 10A

Interest in developing large wind-electric generating systems in the United States was simulated primarily by one man, Palmer C. Putnam. He was responsible for the construction of the 1250 kilowatt Smith-Putnam wind-electric plant. The existence of this system prompted the U. S. Federal Power Commission to investigate the potential of using the winds as a source energy. Also, in 1933 prior to Putnam's effort, there was an abortive attempt by J. D. Madaras to develop a wind system based on the Magnus effect. These three projects comprise the only serious efforts in America to develop large wind driven plants. In this paper the history of each project is briefly described. Also discussed are some of the reasons why wind energy was not seriously considered as a major source of energy for the U. S. Author

N74-34541*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOLAR ENERGY TO HEAT AND COOL A NEW NASA LANGLEY OFFICE BUILDING
W. L. Maag Sep. 1974 22 p refs
(NASA-TM-X-71615; E-8103) Avail: NTIS HC $3.00 CSCL 10A

A solar heating and cooling system will be installed at a new NASA office building. The objective of this project is to establish a full-scale working test-bed facility to investigate solar energy for heating and cooling buildings. The energy collected will provide between 80 and 100 percent of the heating and cooling requirements during the cool months and between one-half and two-thirds of the cooling requirements in the summer. Thermal energy storage will be provided to bridge the gap between cloudy and clear days. Author

N74-34542*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ENERGY AND ECONOMIC ANALYSIS OF TOTAL ENERGY SYSTEMS FOR RESIDENTIAL AND COMMERCIAL BUILDINGS
William L. Maag and Gary Bollenbacher Oct. 1974 19 p refs
(NASA-TM-X-71617; E-8099) Avail: NTIS HC $3.00 CSCL 10A

Energy and economic analyses were performed for an on-site power-plant with waste heat recovery. The results show that for any specific application there is a characteristic power conversion efficiency that minimizes fuel consumption, and that efficiencies greater than this do not significantly improve fuel consumption. This type of powerplant appears to be a reasonably attractive investment if higher fuel costs continue. Author

N74-34543# Committee on Science and Astronautics (U. S. House).
ENERGY FROM OIL SHALE: TECHNICAL, ENVIRONMENTAL, ECONOMIC, LEGISLATIVE, AND POLICY ASPECTS OF AN UNDEVELOPED ENERGY SOURCE
Washington GPO Nov. 1973 71 p refs Rept. Prepared for Subcomm. on Energy of Comm. on Sci. and Astronaut., 93d Congr., 1st Sess., 30 Nov. 1973 Prepared by the Library of Congr., Sci. Policy Res. Div.
(GPO-25-572) Avail: Subcomm. on Energy

Current economic analyses indicate that the processing of oil shale is within or near the range of economic feasibility. Environmental acceptability remains to be tested on a large-scale basis. Advances in environmental control technologies, for example, revegetation and chemical processing of effluents, are said to reduce some of the harmful environmental impacts resulting from development of this resource. This paper discusses proposed legislation concerned with the development of oil shale which would establish a cooperative Government-industry corporation to construct models of an oil shale processing plant to demonstrate the economic feasibility and environmental acceptability of different technological methods, and, if deemed feasible, construct a commercial sized plant. Author

N74-34544# Committee on Public Works (U. S. Senate).
THE FUEL SHORTAGE AND THE CLEAN AIR ACT
Washington GPO 1973 113 p Hearing on S. 2680 before Subcomm. on Air and Water Pollution of Comm. on Public Works, 93d Congr., 1st Sess., 12 Nov. 1973
(GPO-25-885) Avail: Subcomm. on Air and Water Pollution

Variances from clean air requirements are requested to deal with the fuel shortage for a limited duration. Changes in the clean air act implementation plans are intended to give affected utilities and industries the necessary time to install available stack gas emission controls. G.G.

N74-34545*# Eagle-Picher Industries, Inc., Joplin, Mo. Electronics Div.
STUDY OF OXYGEN GAS PRODUCTION PHENOMENON DURING STAND AND DISCHARGE IN SILVER-ZINC BATTERIES Final Report
8 Oct. 1974 75 p

(Contract NAS9-12032)
(NASA-CR-140306) Avail: NTIS HC $6.75 CSCL 10C

Standard production procedures for manufacturing silver zinc batteries are evaluated and modified to reduce oxygen generation during open circuit stand and discharge. Production predictions of several variable combinations using analysis models are listed for minimum gassing, with emphasis on the concentration of potassium hydroxide in plate formation. A recommendation for work optimizing the variables involved in plate processing is included. G.G.

N74-34546# Assistant Secretary of Defense (Installations and Logistics), Washington, D.C.
MANAGEMENT OF DEFENSE ENERGY RESOURCES. EXECUTIVE SUMMARY: REPORT OF THE DEFENSE ENERGY TASK GROUP
15 Nov. 1973 37 p refs
(AD-782267) Avail: NTIS CSCL 10/1

Energy-related problems facing the Department of Defense are summarized. Topic areas discussed are: World and U. S. energy outlook; Defense energy requirements and budget impact; petroleum storage and distribution; fuels standardization; naval petroleum reserves; Defense energy conservation; energy-related R and D; and energy organization and management in DoD. GRA

N74-34547# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
THE F-89 HYDRAULIC ACTUATOR COMBINATORIAL GEOMETRY REPRESENTATION Final Summary Report, Sep. - Dec. 1973
John Dunn and Gerald Bennett Jun. 1974 39 p refs
(AD-781996; ASD/XR-74-9) Avail: NTIS CSCL 01/3

The report summarizes the generation of a geometric model of an F-89 aileron actuator for a computerized vulnerability analysis using the MAGIC target description computer program. The procedures used and problems encountered are discussed and the resulting target description is presented. GRA

N74-34548# Federal Power Commission, Washington, D.C. Office of the Chief Engineer.
STAFF REPORT: A TECHNICAL BASIS FOR ENERGY CONSERVATION
Apr. 1974 57 p refs
(PB-231924/2; FPC/OCE-2) Avail: NTIS HC $3.75 CSCL 10A

A means for evaluating measures for coping with the nation's energy problems and for achieving fuel efficiency is presented. Correction of inefficiencies at the point of consumption of fuel and electric power offers opportunities for improving overall fuel efficiency. In the short run, improved fuel efficiency offers a means for dealing with fuel shortage without severe economic disruption. In the long run, with steeply rising fuel prices a virtual certainty, improved fuel efficiency is an essential part of maintaining a productive, competitive industry, able to supply the goods and services which society requires. GRA

N74-34549# Southern Methodist Univ., Dallas, Tex.
DEVELOPMENT OF LOW-COST THIN-FILM POLYCRYSTALLINE SILICON SOLAR CELLS FOR TERRESTRIAL APPLICATIONS Quarterly Progress Report, 1 Jan. - 31 Mar. 1974
Ting I. Chu Apr. 1974 39 p refs Prepared in cooperation with Texas Instruments, Inc., Dallas
(Grant NSF GI-38981)
(PB-232895/3; NSF-RANN/SE/GI-38981/PR/74/1; NSF-RA/N-74-032; QPR-1) Avail: NTIS HC $3.25 CSCL 10B

The deposition and characterization of polycrystalline silicon solar cells suitable for solar cell fabrication is described, along with the preparation and characterization of p-n junctions and Schottky barriers. The fabrication and evaluation of thin film solar cells with efficiencies and cost projections warranting further research and development support is also discussed. GRA

N74-34550# Sperry Rand Corp., Phoenix, Ariz. Sperry Flight Systems Div.
MODIFICATION OF PROTOTYPE FLY-BY-WIRE SYSTEM TO INVESTIGATE FIBER-OPTIC MULTIPLEXED SIGNAL TRANSMISSION TECHNIQUES Final Report
Stephen Osder and David LeFebre Mar. 1974 133 p refs
(Contract F33615-73-C-3108; AF Proj. 1987)
(AD-783269; AFFDL-TR-74-10; Rept-71-0424-00-00) Avail: NTIS CSCL 01/4

A prototype, quad-redundant, fly-by-wire system developed for the Flight Dynamics Laboratory in 1967 was modified to incorporate a fiber-optic data transmission link in one of the four channels. All data flowing between one of the elevator actuator channels and its control computer was transmitted on multiplexed optical data busses in serial-bit, serial-work format at a 500-KHz bit rate. The channel capacity was several hundred times greater than the maximum requirement anticipated for fly-by-wire application. The system was mechanized with a 100-foot, fiber-optic cable and miniature optical transmitter and receiver modules, having a total bandwidth capability of about 4.0 MHz. System performance was verified, and the compatibility of the optical channel and the other three electrical channels was demonstrated. Various fiber-optic cable jacketing configurations were evaluated, and detailed environmental tests were performed on one type of jacketed cable. (Modified author abstract) GRA

N74-34551# Naval Civil Engineering Lab., Port Hueneme, Calif.
APPLICATION OF FLUIDIC CONCEPTS TO HYDRAULIC CONTROL SYSTEMS Technical Note, 1 Jul. 1972 - 30 Jun. 1973
R. H. Fashbaugh and E. R. Durlak Jul. 1974 21 p refs
(ZF61512001)
(AD-782508; CEL-TN-1349) Avail: NTIS CSCL 13/7

This is the first of a two part test program to determine the feasibility of using fluidic concepts to develop a fluidic control unit that will detect and correct angular variations in position such as those experienced by a bulldozer blade during operation. The hydraulic proximity sensor is a key component in the control unit. Experimental test results are presented showing the evaluation of a fluidic proximity sensor using hydraulic oil as the working fluid. The sensor was designed by scaling a pneumatic proximity sensor using a constant value of Reynolds number as the scaling parameter. Test results show that the hydraulic proximity sensor will detect the distance of an object from the sensor by relating that distance to a pressure signal. The performance characteristics of the hydraulic sensor correlated well with those of the pneumatic sensor. The sensor jet force variation with distance was also determined. Author (GRA)

N74-34552# Army Aviation Systems Command, St. Louis, Mo.
MAJOR ITEM SPECIAL STUDY (MISS), CH-47A AUXILIARY POWER UNIT (T62-T-2A) Interim Report, 1 Jan. 1964 - 1 Jan. 1973
Jul. 1974 20 p refs
(AD-782927; USAAVSCOM-TR-74-35) Avail: NTIS CSCL 01/3

Major Item Special Study (MISS) reports are performed on DA Form 2410 reportable components. These are time change items and certain condition change items selected because of high cost or need for intensive management. Basically, the MISS reports are concerned with analyzing reported removal data presented in the Major Item Removal Frequency (MIRF) report. The failure modes reported for each removal are examined and grouped into categories which are intended to clarify the intent of the data reporting. From this data, removal distribution can be plotted and an MTR (mean time to removal) can be calculated. The MISS reports then investigate possible cost savings based on total elimination of selected failure modes. These modes are chosen because of the percentage of failure modes. These modes are chosen because of the percentage of failures they represent and/or because they appear to be feasible Product Improvement Program (PIP) areas. Author (GRA)

N74-34553# Eagle-Picher Industries, Inc., Joplin, Mo. Couples Dept.
LEAD-ACID RESERVE BATTERY Final Report
L. R. Erisman Apr. 1974 38 p
(Contract DAAA21-73-C-0540)
(AD-782910) Avail: NTIS CSCL 10/3

The report discusses the development of a Lead Acid Reserve Battery identified as Eagle-Picher Battery number GAP-1500.

The overall program was divided into two major parts, Battery Electrochemical Design (Part I) and Activation Mechanism Design Incorporation (Part II). The final battery configuration, is shown. GRA

N74-34554# Boeing Aerospace Co., Seattle, Wash.
COCKPIT SWITCHING STUDY: TEST AND VALIDATION OF A DESIGN PROCEDURE FOR MULTIFUNCTION SWITCHING CONTROLS Annual Technical Report, 1 Feb. 1973 - 31 Jan. 1974
David K. Graham Jul. 1974 237 p refs
(Contract N00014-72-C-0191; NR Proj. 213-088)
(AD-783956; D180-18069-1; JANAIR-740701) Avail: NTIS

The document reports the test and validation of a handbook design procedure, developed during an earlier study, for the step-by-step design of multifunction switching controls (MSC's). An MSC panel for the Navigation and Weapons Delivery System of the A-7E airplane was designed using the procedure, and this panel was then analytically compared with conventional controls on the basis of pilot workload. Variations of the baseline MSC were also designed and tested to ascertain the effect of imposing constraints on the design procedure. The workload comparison was accomplished using a digital computer program developed specifically for workload evaluation. Results show the MSC panels in all respects at least equal, and in most cases superior, to conventional controls on the basis of pilot workload. In addition to the workload advantage, the baseline MSC panel occupied only one-tenth the panel space required for equivalent conventional controls. (Modified author abstract) GRA

N74-34555# Naval Weapons Lab., Dahlgren, Va.
AIRCREW AUTOMATED ESCAPE SYSTEM SIMULATION MODEL
Christopher Gracey Feb. 1974 91 p refs
(AD-783517; NWL-TR-3) Avail: NTIS CSCL 01/3

A math model is presented for simulating the performance of the SEU-3/A Ejection Seat Escape System which employs propulsion, parachute, and stabilization subsystems. Seat/man, man alone, and seat alone configurations are treated as rigid bodies in six degrees-of-freedom. Canopy first recovery parachute deployment by rocket and/or drogue parachute is modelled as well as lines first drouge deployment. Parachute opening equations are treated in detail, and riser/suspension line forces are assumed to be elastic. In addition, an aircraft model is formulated. Author (GRA)

N74-34556# Payne, Inc., Annapolis, Md.
ON THE AVOIDANCE OF LIMB FLAIL INJURY BY EJECTION SEAT STABILIZATION Final Report, 1 Oct. 1972 - 31 Mar. 1974
Peter R. Payne May 1974 87 p refs
(Contract F33615-73-C-4006; AF Proj. 7231)
(AD-783913; Working-Paper-106-5; AMRL-TR-74-9) Avail: NTIS

After a review of the various causes of limb flail injury during high speed escape from an aircraft in an open ejection seat, the problem of flailing due to seat aerodynamic instability is addressed. The author concluded that there is no practical way of avoiding injury in an unstable seat. The causes of ejection seat instability are then examined, and a number of conventional and unconventional stabilization systems discussed. The author concluded that a new approach -- the in-plane stabilizer -- is probably the optimum solution to the problem. The theory of the in-plane stabilizer is developed and its effectiveness confirmed by full scale wind tunnel tests with an F-105 seat containing live human subjects. Author (GRA)

N74-35148 Princeton Univ., N.J.
SUMMARY OF TECHNICAL FEATURES
R. G. Mills *In its* A Fusion Power Plant Aug. 1974 p 10-19 refs (For availability see N74-35146 24-25)

N74-35149 Princeton Univ., N.J.
ADVANTAGES OF FUSION POWER
P. Bonanos *In its* A Fusion Power Plant Aug. 1974 p 20-23 ref (For availability see N74-35146 24-25)

N74-35151 Princeton Univ., N.J.
THE OPERATING CYCLE
S. L. Gralnick *In its* A Fusion Power Plant Aug. 1974 p 40-74 refs (For availability see N74-35146 24-25)

N74-35152 Princeton Univ., N.J.
THE DIVERTER AND VACUUM SYSTEM
F. H. Tenney and G. Lewin *In its* A Fusion Power Plant Aug. 1974 p 75-125 refs (For availability see N74-35146 24-25)

N74-35154 Princeton Univ., N.J.
MAGNETICS
U. R. Christensen *In its* A Fusion Power Plant Aug. 1974 p 138-147 (For availability see N74-35146 24-25)

N74-35155 Princeton Univ., N.J.
CHOICE OF MATERIALS
F. H. Tenney *In its* A Fusion Power Plant Aug. 1974 p 148-163 refs (For availability see N74-35146 24-25)

N74-35158 Princeton Univ., N.J.
THE VACUUM WALL, RADIATION DAMAGE, STRUCTURAL PROBLEMS
P. Bonanos and H. K. Perkins *In its* A Fusion Power Plant Aug. 1974 p 291-322 refs (For availability see N74-35146 24-25)

N74-35159 Princeton Univ., N.J.
SUPERCONDUCTING MAGNETS AND CRYOGENIC SYSTEMS
J. File *In its* A Fusion Power Plant Aug. 1974 p 323-361 refs (For availability see N74-35146 24-25)

N74-35160 Princeton Univ., N.J.
FUEL HANDLING
E. F. Johnson *In its* A Fusion Power Plant Aug. 1974 p 362-410 refs (For availability see N74-35146 24-25)

N74-35161 Argonne National Lab., Ill.
TRITIUM DISTRIBUTION AND LEAKAGE
Victor A. Maroni *In* Princeton Univ. A Fusion Power Plant Aug. 1974 p 411-431 refs (For availability see N74-35146 24-25)

N74-35163 Westinghouse Electric Corp., Pittsburgh, Pa.
ENVIRONMENTAL COMPATIBILITY
P. W. Davison *In* Princeton Univ. A Fusion Power Plant Aug. 1974 p 458-476 refs (For availability see N74-35146 24-25)

N74-35164 Princeton Univ., N.J.
OPERATIONAL PROCEDURES
K. C. Sokolosky (Narragansett Elec. Co.) and J. File *In its* A Fusion Power Plant Aug. 1974 p 477-492 (For availability see N74-35146 24-25)

N74-35165 Argonne National Lab., Ill.
MAINTENANCE, REPAIR AND OVERHAUL
T. A. Coultas *In* Princeton Univ. A Fusion Power Plant Aug. 1974 p 493-507 refs (For availability see N74-35146 24-25)

N74-35167 Princeton Univ., N.J.
USES FOR THE REFERENCE DESIGN
R. G. Mills *In its* A Fusion Power Plant Aug. 1974 p 526-530 refs (For availability see N74-35146 24-25)

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N74-34557*# National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 131, AUGUST 1974

Aug. 1974 81 p refs
(NASA-SP-7011(131)) Avail: NTIS HC $4.00 CSCL 06E

This special bibliography lists 266 reports, articles, and other documents introduced into the NASA scientific and technical information system in July 1974. Author

N74-34558*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MICROBIOLOGICAL ASPECTS OF CLEAN ROOM TECHNOLOGY AS APPLIED TO SURGERY, WITH SPECIAL REFERENCE TO UNIDIRECTIONAL AIRFLOW SYSTEMS
Michael D. Wardle 9 Jul. 1974 88 p refs
(Contract NAS7-100)
(NASA-CR-140176; JPL-SP-43-7) Avail: NTIS HC $7.50 CSCL 06E

The microbiological aspects of clean room technology as applied to surgery were reviewed. The following pertinent subject areas were examined: (1) clean room technology per se and its utilization for surgery, (2) microbiological monitoring of the clean room surgical environment, (3) clean rooms and their impact on operating room environmental microbiology, and (4) the effect of the technology on surgical wound infection rates. Conclusions were drawn for each topic investigated. Author

N74-34559*# Minnesota Univ., Minneapolis. Space Science Center.
PROJECT ENVIRONMENTAL MICROBIOLOGY AS RELATED TO PLANETARY QUARANTINE Summary Progress Report, 1 Jun. - 30 Nov. 1973
Irving J. Pflug 30 Nov. 1973 28 p
(Grant NGL-24-005-160)
(NASA-CR-140522) Avail: NTIS HC $4.50 CSCL 06M

The viability and dry heat resistance of indigenous microflora associated with small soil particles were investigated. An aluminum boat TDT CUP-TSA solid media system was developed for the analyses; a complete description of the technique is included. Data cited here were obtained using analyses of individual soil particles. Detailed particle viability profiles for dry heat effects were determined for Kennedy Space Center soil. At 110 C at least some particles retained viability through a heating period of between 8 and 16 hours. Single particles heated at 125 C for 80 minutes or longer did not show evidence of viability under test conditions. Preliminary aerobic, mesophilic plate counts of the 74-88 micron m soil fraction yielded mean values of 16.2 organisms per dark particle and 2.6 organisms per light particle. Heat treatment of particles in a dry atmosphere did not appear to increase the rate of inactivation for in situ soil particle microflora. Author

N74-34560# National Research Council of Canada, Ottawa (Ontario). Control Systems Lab.
A NEW APPROACH TO THE EXPERIMENTAL MODELLING OF SPINAL CORD INJURIES
W. Cook (Queens Univ.), A. Sierhuis, C. Romero-Sierra (Queens Univ.), and R. Hansebout (Montreal Neurol. Inst.) Dec. 1972 10 p refs
(LTR-CS-92) Avail: NTIS HC $4.00

Methods of creating spinal cord lesions were investigated. The two methods were compression by a belt around the cord and compression by inflating a saddle-shaped balloon. It was found that the belt has many basic disadvantages whereas compression by balloon is effective, efficient and adaptable to each animal individually. Author

N74-34561# Medical Coll. of Wisconsin, Milwaukee. Dept. of Environmental Medicine.
THE EFFECT OF CARBON MONOXIDE ON TIME PERCEPTION Final Report
Richard D. Stewart, Paul E. Newton, Michael J. Hosko, and Jack E. Peterson Jan. 1973 54 p refs
(Contract EPA-CPA-70-7)
(PB-232544/7; MCOW-ENVM-CO-72-2; CRC-APRAC-CAPA-3-68; EPA-650/1-74-005) Avail: NTIS HC $3.75 CSCL 06T

Twenty-seven healthy, adult male and female volunteers were exposed to carbon monoxide at concentrations of smaller than 2, 50, 100, 200 and 550 ppm for periods up to 4 1/2 hours for the purpose of determining the effect of gas upon time perception. These exposures, which resulted in a range of carboxyhemoglobin saturations up to 20%, produced no impairment in the ability of the subject to perform the Beard-Wertheim time discrimination test, to estimate ten or thirty second intervals, or to perform the Marquette time estimation test. GRA

N74-34562# Wayne State Univ., Detroit, Mich. Dept. of Neurosurgery.
BREAKING STRENGTH OF THE HUMAN SKULL VS IMPACT SURFACE CURVATURE Final Report, 20 Dec. 1971 - 31 Mar. 1973
R. Voigt and L. Murray Thomas Nov. 1973 189 p refs
(Contract DOT-HS-146-2-230)
(PB-233041/3; DOT-HS-801-002) Avail: NTIS HC $5.50 CSCL 06E

The effects of surface shape, hardness and impact location on the heads of human cadavers are observed. Impact surfaces included flat rigid and resilient, rigid cylindrical 1/8 in. radius up to 1 in. radius, resilient cylindrical 1 in. radius and rigid hemispherical shapes ranging from 3 in. to 8 in. radius. Impact locations include front, side and rear. The various impact conditions are related to type of skull fracture produced and several head injury parameters such as, velocity, peak force, acceleration, contact pressure and magnitude, and head injury criterion. GRA

N74-34563# School of Aerospace Medicine, Brooks AFB, Tex.
THE USAFSAM FACILITY FOR STUDIES UTILIZING LOW DOSE, LOW DOSE RATE IONIZING RADIATION Interim Report, 1 Apr. 1970 - 1 Jan. 1974
Jerry D. Siders, Jerome H. Krupp, and Kenneth A. Hardy Jun. 1974 10 p
(AF Proj. 7757)
(AD-782009; SAM-TR-74-16) Avail: NTIS CSCL 06/18

A facility was designed and built to provide continuous exposure to low-dose, low-dose-rate ionizing radiation. Four 60Co irradiators were fabricated by Technical Services Division, Oak Ridge Associated Universities (ORAU); a uniform exposure from 500 mrad to 2.5 R/day can be provided to an area of 512 cu ft (8 ft x 8 ft x 8 ft). Author (GRA)

N74-35058 Joint Publications Research Service, Arlington, Va.
EFFECT AND AFTEREFFECT OF SPRING FROST ON WINTER WHEAT AS A FUNCTION OF NIGHT TEMPERATURES IN THE FALL AND SPRING
V. M. Mokiyevskiy *In its* Meteorol. and Hydrol., No. 7, 1974 (JPRS-63109) 2 Oct. 1974 p 92-98 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 7, 1974 p 74-78 (For availability see N74-35046 24-20)

N74-35064 Joint Publications Research Service, Arlington, Va.
SIGNIFICANCE OF THE DEGREE OF DEVELOPMENT OF WINTER WHEAT IN THE FALL FOR ITS WINTERING AND HARVEST IN THE NORTHERN CAUCASUS, IN THE ROSTOV OBLAST AND IN THE LOWER VOLGA REGION
I. V. Svisyuk *In its* Meteorol. and Hydrol., No. 7, 1974 (JPRS-63109) 2 Oct. 1974 p 127-131 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 7, 1974 p 94-96 (For availability see N74-35046 24-20)

N74-35065 Joint Publications Research Service, Arlington, Va.
EFFECT OF WEATHER CONDITIONS ON THE RICE HARVEST IN THE ASTRAKHAN OBLAST
V. I. But *In its* Meteorol., and Hydrol. No. 7, 1974 (JPRS-63109) 2 Oct. 1974 p 132-136 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 7, 1974 p 96-98 (For availability see N74-35046 24-20)

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N74-34564*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE NASA FIREFIGHTER'S BREATHING SYSTEM PRO-

GRAM Status Report
Pat B. McLaughlan and Maurice A. Carson 10 May 1974 25 p Revised
(NASA-TM-X-70343) Avail: NTIS HC $4.25 CSCL 06K

The research is reported in the development of a firefighter's breathing system (FBS) to satisfy the operational requirements of fire departments while remaining within their cost constraints. System definition for the FBS is discussed, and the program status is reported. It is concluded that the most difficult problem in the FBS Program is the achievement of widespread fire department acceptance of the system. F.O.S.

N74-34565*# Pennsylvania State Univ., University Park. Transportation Inst.
REPORT ON OBJECTIVE RIDE QUALITY EVALUATION
J. C. Wambold and W. H. Park Mar. 1974 244 p refs
(Grant NGR-39-009-256)
(NASA-CR-132538; PTI-7412) Avail: NTIS HC $15.25 CSCL 05E

The correlation of absorbed power as an objective ride measure to the subjective evaluation for the bus data was investigated. For some individual bus rides the correlations were poor, but when a sufficient number of rides was used to give reasonable sample base, an excellent correlation was obtained. The following logarithmical function was derived: S = 1.7245 1n (39.6849 AP), where S = one subjective rating of the ride; and AP = the absorbed power in watts. A six-degree-of-freedom method developed for aircraft data was completed. Preliminary correlation of absorbed power with ISO standards further enhances the bus ride and absorbed power correlation numbers since the AP's obtained are of the same order of magnitude for both correlations. While it would then appear that one could just use ISO standards, there is no way to add the effect of three degrees of freedom. The absorbed power provides a method of adding the effects due to the three major directions plus the pitch and roll. Author

N74-34566*# AiResearch Mfg. Co., Torrance, Calif.
EVALUATION OF A LIQUID AMINE SYSTEM FOR SPACECRAFT CARBON DIOXIDE CONTROL Final Report
D. K. Breaux, P. Friedel, K. C. Hwang, G. Probert, J. M. Ruder, and L. Sawamura Sep. 1974 68 p refs
(Contract NAS1-11895)
(NASA-CR-137560; AiResearch-74-10178) Avail: NTIS HC $6.50 CSCL 06K

The analytical and experimental studies are described which were directed toward the acquisition of basic information on utilizing a liquid amine sorbent for in use in a CO2 removal system for manned spacecraft. Liquid amine systems are successfully used on submarines for control of CO2 generated by the crew, but liquid amines were not previously considered for spacecraft applications due to lack of development of satisfactory rotary phase separators. Developments in this area now make consideration of liquid amines practical for spacecraft system CO2 removal. The following major tasks were performed to evaluate liquid amine systems for spacecraft: (1) characterization, through testing, of the basic physical and thermodynamic properties of the amine solution; (2) determination of the dynamic characteristics of a cocurrent flow absorber; and (3) evaluation, synthesis, and selection of a liquid amine system concept oriented toward low power requirements. A low weight, low power system concept was developed. Numerical and graphical data are accompanied by pertinent observations. Author

N74-34567*# Michigan Univ., Ann Arbor. Dept. of Aerospace Engineering.
THE EFFECT OF SIMULATOR DYNAMICS ON PILOT RESPONSE
Earl F. Weener 2 Oct. 1974 67 p refs
(Contract NSR-23-005-364)
(NASA-CR-132459) Avail: NTIS HC $6.50 CSCL 05E

The effects of visual display dynamics on the altitude tracking performance of a subject in a fixed base flight simulator are considered. The subject, flying the linearized longitudinal equations of motion, attempts to maintain the same altitude as two airplanes positioned three hundred feet ahead, as in level formation flying. The horizon together with the two leading aircraft are represented symbolically on a CRT display. The subject's aircraft is disturbed by atmospheric turbulence. The data indicate a relationship between the bandwidth of the display dynamics and the short period characteristics of the simulated airplane. For an airplane with a relatively fast pitch response the presence of altitude display dynamics, with a bandwidth as high as five times the short period natural frequency, causes significant degradation of altitude tracking performance. Author

N74-34568*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE EFFECTS OF BED REST ON CREW PERFORMANCE DURING SIMULATED SHUTTLE REENTRY. VOLUME 1: STUDY OVERVIEW AND PHYSIOLOGICAL RESULTS
Alan Chambers and Hubert C. Vykukal Washington Oct. 1974 33 p refs
(NASA-TN-D-7503; A-5241-Vol-1) Avail: NTIS HC $3.25 CSCL 06S

A centrifuge study was carried out to measure physiological stress and control task performance during simulated space shuttle orbiter reentry. Jet pilots were tested with, and without, anti-g-suit protection. The pilots were exposed to simulated space shuttle reentry acceleration profiles before, and after, ten days of complete bed rest, which produced physiological deconditioning similar to that resulting from prolonged exposure to orbital zero g. Pilot performance in selected control tasks was determined during simulated reentry, and before and after each simulation. Physiological stress during reentry was determined by monitoring heart rate, blood pressure, and respiration rate. Study results indicate: (1) heart rate increased during the simulated reentry when no g protection was given, and remained at or below pre-bed rest values when g-suits were used; (2) pilots preferred the use of g-suits to muscular contraction for control of vision tunneling and grayout during reentry; (3) prolonged bed rest did not alter blood pressure or respiration rate during reentry, but the peak reentry acceleration level did; and (4) pilot performance was not affected by prolonged bed rest or simulated reentry. Author

N74-34569*# Gulf South Research Inst., New Orleans, La.
WATER VAPOR DIFFUSION MEMBRANES Final Report
F. F. Holland, Jr. and J. K. Smith Sep. 1974 65 p refs
(Contract NAS2-7650)
(NASA-CR-137545) Avail: NTIS HC $6.25 CSCL 06K

The program is reported, which was designed to define the membrane technology of the vapor diffusion water recovery process and to test this technology using commercially available or experimental membranes. One membrane was selected, on the basis of the defined technology, and was subjected to a 30-day demonstration trial. Author

N74-34570# Advisory Group for Aerospace Research and Development, Paris (France).
OPERATIONAL ASPECTS OF VARIATIONS IN ALERTNESS
Bryce O. Hartman (School of Aerospace Med.), William F. Storm (School of Aerospace Med.), John E. Vanderveen (School of Aerospace Med.), Ernestine Vanderveen (School of Aerospace Med.), Henry B. Hale (School of Aerospace Med.), and Ralph R. Bollinger (School of Aerospace Med.) Aug. 1974 42 p refs
(AGARD-AG-189; AGARDograph-189) Avail: NTIS HC $5.25

Variations in alertness undoubtedly affect operator performance, sometimes to a degree which significantly degrades operational effectiveness. Alertness is a biological state with behavioral, neurophysiological and biochemical elements. Related states are vigilance, attention, and arousal. This monograph summarizes the literature on these topics, as well as the influence of various environments on alertness levels, spontaneous fluctuations in alertness, and effects of such variation on operator performance. The environments under consideration include long duration flights, flights at night, monotonous tasks, solitude, mild hypoxia, and variations in thermal conditions in a flight compartment. Author

N74-34571*# Systems Technology, Inc., Hawthorne, Calif.
THE EFFECTS OF BEDREST ON CREW PERFORMANCE DURING SIMULATED SHUTTLE REENTRY. VOLUME 2: CONTROL TASK PERFORMANCE Final Report
Henry R. Jex, Richard A. Peters, Richard J. DiMarco, and R.

Wade Allen Washington NASA Oct. 1974 99 p refs
(Contract NAS2-6409)
(NASA-CR-2367) Avail: NTIS HC $4.00 CSCL 06S

A simplified space shuttle reentry simulation performed on the NASA Ames Research Center Centrifuge is described. Anticipating potentially deleterious effects of physiological deconditioning from orbital living (simulated here by 10 days of enforced bedrest) upon a shuttle pilot's ability to manually control his aircraft (should that be necessary in an emergency) a comprehensive battery of measurements was made roughly every 1/2 minute on eight military pilot subjects, over two 20-minute reentry Gz vs. time profiles, one peaking at 2 Gz and the other at 3 Gz. Alternate runs were made without and with g-suits to test the help or interference offered by such protective devices to manual control performance. A very demanding two-axis control task was employed, with a subcritical instability in the pitch axis to force a high attentional demand and a severe loss-of-control penalty. The results show that pilots experienced in high Gz flying can easily handle the shuttle manual control task during 2 Gz or 3 Gz reentry profiles, provided the degree of physiological deconditioning is no more than induced by these 10 days of enforced bedrest. Author

N74-34572# National Inst. for Occupational Safety and Health, Cincinnati, Ohio.
AN INSTRUMENT FOR TESTING ISOMETRIC STRENGTH AND ENDURANCE Final Report
D. F. Wasserman, T. Germann, D. V. Goulding, and F. Pizzo May 1974 33 p refs
(PB-233100/7; DHEW/NIOSH-74-109; NIOSH-TR-211-74) Avail: NTIS HC $4.75 CSCL 06B

A technical description is given of a versatile instrumentation system designed to obtain, monitor, and process human static strength and isometric endurance data. The system includes in-house designed mechanical and electronic apparatus as well as commercially available apparatus. Examples of the system's use with human subjects are presented. GRA

N74-34573# Whittaker Corp., Waltham, Mass. Space Sciences Div.
FEASIBILITY STUDY ON A TELEVISION TECHNIQUE FOR MEASURING HUMAN EYE MOVEMENT Final Report
Jun. 1974 28 p refs
(Contract F33615-73-C-4122; AF Proj. 7222)
(AD-782037; AMRL-TR-74-74) Avail: NTIS CSCL 06/2

Counterroll measurements on the eyes of subjects undergoing various vestibular stimuli is of great interest and accumulation of data for analysis is an important part of such a study. It is very desirable to automate this measurement process of determining counterroll angle of the subject's eye at each instant of time. The objectives of this feasibility study are: To determine the possibility of automating the counterroll measurement from photographic slides; to determine the best possible measurement resolution that can be obtained under optimum conditions; and to consider various practical approaches to the instrumentation in order to effect a most satisfactory solution to this problem, including the feasibility of using video tape instead of photographic slides. GRA

N74-35162 Westinghouse Electric Corp., Pittsburgh, Pa.
KAZARDS
P. W. Davison *In* Princeton Univ. A Fusion Power Plant Aug. 1974 p 432-457 refs (For availability see N74-35146 24-25)

06 CHEMISTRY

Includes chemical analysis and identification (e.g. spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N74-34574# National Research Council of Canada, Ottawa (Ontario).
EFFECT OF COMPOSITION OF ABSORBENT ON THE RATE OF ABSORPTION OF SO2 FROM GASES
B. A. Chertkov 1974 15 p refs Transl. into ENGLISH from Khim. Prom. (Leningrad), v. 3, 1960 p 223-227
(NRC-TT-1765) Avail: NTIS HC $4.00

Changes in absorption rate and composition of absorbing solution are determined experimently. The results are evaluated, based on mass transfer coefficient K, which can be calculated for each initial composition of the absorbent from kinetic equations. The driving force in certain absorption processes is not only the partial pressure of the absorbed component in the gas phase, but also the free chemical capacity of the absorbent, which depends on the concentration and the degree of saturation of the latter. J.A.M.

N74-34575*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.
MULTIDISCIPLINARY RESEARCH IN SPACE SCIENCES AND ENGINEERING WITH EMPHASIS ON THEORETICAL CHEMISTRY Final Report, 1 Jul. 1962 - 30 Sep. 1974
Joseph O. Hirschfelder and C. F. Curtiss Oct. 1974 110 p refs
(Grant NGL-50-002-001)
(NASA-CR-140518; MISC-109) Avail: NTIS HC $8.50 CSCL 07D

A broad program is reported of research in theoretical chemistry, particularly in molecular quantum and statistical mechanics, directed toward determination of the physical and chemical properties of materials, relation of these macroscopic properties to properties of individual molecules, and determination of the structure and properties of the individual molecules. Abstracts are presented for each research project conducted during the course of the program. A.A.D.

N74-34576*# Techtran Corp., Glen Burnie, Md.
AMINO ACIDS AND CARBOHYDRATES IN VERY ANCIENT DEPOSITS (ACCORDING TO THE EXAMPLE OF THE CYANITE SCHISTS ON THE KOLA PENINSULA)
I. Z. Sergiyenko, M. I. Bobyleva, Sv. A. Sidorenko, and I. A. Yegorov Washington NASA Oct. 1974 9 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 215, no. 2, 1974 p 474-477
(Contract NASw-2485)
(NASA-TT-F-15829) Avail: NTIS HC $4.00 CSCL 07D

Recently considerable material was accumulated on the discovery of amino acids and carbohydrates in very ancient layers of the earth. Although these compounds can be produced through non-biologic means, the authors presume that these compounds are of a biological origin even though the deposits are sometimes over 2.6 billion years old. Author

N74-34577*# IIT Research Inst., Chicago, Ill. Technology Center.
FUNDAMENTAL INVESTIGATION OF ULTRAVIOLET RADIATION EFFECTS IN POLYMERIC FILM-FORMING MATERIALS Report for 13 Jul. 1973 - 12 Apr. 1974
C. Giori, T. Yamauchi, P. Llewellen, and J. Gilligan 12 Apr. 1974 82 p refs
(Contract NAS1-12549)
(NASA-CR-132493; IITRI-C6295-10) Avail: NTIS HC $4.00 CSCL 07D

A literature search from 1958 to present was conducted on the effect of ultraviolet radiation on polymeric materials, with particular emphasis on vacuum photolysis, mechanisms of degradation, and energy transfer phenomena. The literature from 1958 to 1968 was searched manually, while the literature from 1968 to present was searched by using a computerized keyword system. The primary objective was to provide the necessary background information for the design of new or modified materials with improved stability to the vacuum-radiation environment of space. Author

N74-34578*# Oregon State Univ., Corvallis. Dept. of Chemistry.
ELEMENTAL ABUNDANCES IN METEORITIC AND TERRESTRIAL MATTER Annual Progress Report, 1 Sep. 1973 - 31 Aug. 1974
Roman A. Schmitt 31 Aug. 1974 51 p refs
(Grant NGL-38-002-020)
(NASA-CR-140627) Avail: NTIS HC $5.75 CSCL 07D

Major and trace element analyses of over 180 individual chondrules from 12 carbonaceous chondrites are reported,

including individual analyses of 60 chondrules from Pueblito de Allende. Siderophile elements in most chondrules are depleted, compared to the whole chondrite. Correlations of Al-Ir and Ir-Sc among chondrules high in Ca and Al were observed. A Cu-Mn correlation was also found for chondrules from some meteorites. No correlation was observed between Au and other siderophile elements (Fe, Ni, Co and Ir). It is suggested that these elemental associations were present in the material from which the chondrules formed. Compositionally, chondrules appear to be a multicomponent mixture of remelted dust. One component displaying an Al-Ir correlation is identified as Allende-type white aggregates. The other components are a material chemically similar to the present matrix and sulfides-plus-metal material. Abundances of the REE (rare earth elements) were measured in ordinary Allende chondrules and were 50% higher than REE abundances in Mokoia chondrules; REE abundances in Ca-Al rich chondrules were similar to REE abundances in Ca-rich white aggregates.
Author

N74-34579*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CATALYTIC TRIMERIZATION OF AROMATIC NITRILES AND TRIARYL-S-TRIAZINE RING CROSS-LINKED HIGH TEMPERATURE RESISTANT POLYMERS AND COPOLYMERS MADE THEREBY Patent Application
Li-Chen Hsu, inventor (to NASA) Filed 10 Oct. 1974 45 p (NASA-Case-LEW-12053-1; US-Patent-Appl-SN-513613) Avail: NTIS HC $5.25 CSCL 07C

Aromatic nitrile compounds, aromatic nitrile-modified (terminated and/or appended) imide, benzimidazole, imidazopyrrolone, and quinoxaline prepolymers, and aromatic dinitrile compounds were trimerized by heating to a temperature in the range of from about 100 C to about 700 C, and preferably in the range of from about 200 C to about 350 C, in the presence of a catalyst or mixture of catalysts selected from one or more of the following groups: (1) organic sulfonic and sulfinic acids; (2) organic phosphonic and phosphinic acids; and (3) metallic acetylacetonates. The process occurs at a pressure range of from about atmospheric pressure to about 10,000 p.s.i., and preferably in the range of from about 200 p.s.i. to about 750 p.s.i. The catalytic trimerization process is carried out in the presence of reinforcing filler material. The particular catalysts, moderate temperatures, and pressures employed in the trimerization process, and the processable filler-reinforced composites and polymers produced thereby, exhibit good thermal-oxidative stability and high performance structural properties at elevated temperatures.
Author

N74-34580*# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
PLASMA SPECTROSCOPY OF URANIUM AND TUNGSTEN, PART 1 Final Report
T. D. Wilkerson Aug. 1973 7 p refs
(Grant NGL-21-002-167)
(NASA-CR-121240; BN-801-Pt-1) Avail: NTIS HC $4.00 CSCL 07D

Results of research on uranium and tungsten spectra are summarized. Measurements of visible line spectra and opacities were carried out on shock tube plasmas which, prior to shock compression, were mixtures of rare gases and UF6 or WF6. Opacities were compared to theoretical predictions. Feasibility of light source methods other than the shock tube was explored for future applications in the spectroscopy of heavy metals and ions.
Author

N74-34581*# Kanner (Leo) Associates, Redwood City, Calif.
EQUILIBRIUM OF OXIDATION-REDUCTION CONVERSION OF GRANULATED REDOXITES
A. Ya. Shatalov, T. A. Kravchenko, and Z. F. Aleksandrova Washington NASA Oct. 1974 9 p refs Transl. into ENGLISH from Z. Fiz. Khim. (USSR), v. 48, no. 3, 1974 p 639-642
(Contract NASw-2481)
(NASA-TT-F-15959) Avail: NTIS HC $4.00 CSCL 07D

A thermodynamic calculation is made of the degree of equilibrium oxidation reduction conversion of quinone-hydroquinone and metal containing redoxites, its experimental verification with respect to the redox potential was carried out. The effect of various factors on the completeness of the utilization of the theoretical potential is noted.
Author

N74-34582*# Scientific Translation Service, Santa Barbara, Calif.
THE OXIDATIVE-REDUCTION POTENTIAL OF THE REDOXITES
A. Ya. Shatalov, T. A. Kravchenko, E. F. Aleksandrova, and G. G. Krivneva Washington NASA Oct. 1974 10 p refs Transl. into ENGLISH from Zh. Fiz. Khim. (USSR), v. 48, no. 3, Mar. 1974 p 613-616
(Contract NASw-2483)
(NASA-TT-F-15960) Avail: NTIS HC $4.00 CSCL 07D

An analysis is made of the thermodynamic principles of the quinone and quinone-hydroquinone and metallic redoxites; a relationship is established between the equilibrium potentials and the degree of oxidative-reduction conversions. The hypothesis of the absence of an effect of the potential of a quinone-hydroquinone polymer on the equilibrium state is experimentally established. The potential of the metallic redoxite is measured.
Author

N74-34583# National Research Council of Canada, Ottawa (Ontario).
ELECTROKINETIC POTENTIAL AND STABILITY OF AQUEOUS SUSPENSIONS OF TiC
B. V. Eremenko, I. N. Lyubchenko, and I. A. Uskov 1974 8 p refs Transl. into ENGLISH from Fiz. -Khim. Mekh. Liofilnost Dispersnykh Sistem (USSR), v. 3, 1971 p 43-46
(NRC-TT-1761) Avail: NTIS HC $4.00

The effects of acids and alkalies on the beta potential and the stability of TiC suspensions are studied. TiC suspensions in pure water are characterized by low negative zeta potentials. Addition of alkalies increases the negative zeta potential, which reaches a maximum at pH approximately 11.5 in commercial TiC and pH approximately 12.4 in purified samples. A further increase in the concentration of alkalies results in an abrupt decrease of the zeta potential. Addition of HCl results in a decrease of the zeta potential and a recharge on the TiC surface. Author

N74-34584# Naval Postgraduate School, Monterey, Calif.
THE COLLISIONAL EXCITATION OF NITROGEN BY LOW ENERGY ELECTRONS TO THE SECOND POSITIVE M.S. Thesis
Steven Wayne Ader and William Charles Doerner Jun. 1974 28 p refs
(AD-781610) Avail: NTIS CSCL 07/4

An experiment was conducted to determine the effective excitation cross sections for forming the C triplet Pi(u) 2nd positive state of N2 in the lowest vibrational energy level by bombarding gaseous nitrogen with electrons in the energy range 80 to 900 eV. When the nitrogen was bombarded by 250 eV electrons the effective cross section was determined to be (1.72 plus or minus .22) x 10 to the -17th power sq cm which was the maximum value of the cross section measured. (Modified author abstract)
GRA

N74-34585# Ohio State Univ. Research Foundation, Columbus.
FUNDAMENTAL STUDIES OF DISSOLUTION AND PASSIVITY OF ALLOYS AND COMPOUNDS Annual Report, 1 Mar. 1973 - 28 Feb. 1974
R. W. Staehle and J. B. Lumsden May 1974 53 p refs
(Contract N00014-67-A-0232-0006; NR Proj. 036-085)
(AD-781911; OSURF-3003-5-Pt-1) Avail: NTIS CSCL 07/4

Ellipsometry was used to study optical properties and kinetics of film growth on iron in 0.1 normal sodium ortho-phosphate solutions differing in pH. Properties and thicknesses of films grown at room temperature were found to vary within wide limits depending upon pH, potential and presence or absence of oxygen. In aerated Na3PO4 solution, gamma-Fe2O3 or Fe3O4 film is formed. At anodic polarization potentials and at pH 7 or higher, iron oxide films are also formed. On the other hand, at open circuit potentials in aerated solutions of pH 7.0 and pH 9.1, a multiple phosphate film is produced. Such a film decreases the corrosion rate of iron shifting its open circuit potential to more noble values. The growth rate of iron oxide films, and that of phosphate films at higher pH values than 7.2, follow a logarithmic law. (Modified author abstract)
GRA

N74-34586# Systems Applications, Inc., San Rafael, Calif.
MATHEMATICAL SIMULATION OF ATMOSPHERIC PHOTOCHEMICAL REACTIONS: MODEL DEVELOPMENT, VALIDATION, AND APPLICATION Final Report
Thomas A. Hecht, Philip M. Roth, and John H. Seinfeld Jul. 1973 164 p refs
(Contract EPA-68-02-0580)
(PB-233049/6; EPA-650/4-74-011) Avail: NTIS HC $11.25 CSCL 07E

The development and evaluation of a kinetic mechanism, for use in air quality simulation models to describe photochemical smog formation, is described. The mechanism, which treats inorganic reactions in detail and organic reactions in general terms, was formulated to achieve a balance between accuracy of prediction and compactness of representation. The results of the evaluation of this mechanism using n-butane/NOx, propylene/NOx, and n-butane/propylene/NOx smog chamber data are included. GRA

N74-34587# Bureau of Mines, Washington, D.C.
CHEMICAL THERMODYNAMIC PROPERTIES OF HYDROCARBONS AND RELATED SUBSTANCES. PROPERTIES OF THE ALKANE HYDROCARBONS, C SUB 1 THROUGH C SUB 10 IN THE IDEAL GAS STATE FROM 0 TO 1500 K
Donald W. Scott May 1974 194 p refs Sponsored in part by Am. Petroleum Inst.
(PB-233210/4; BM-B-666) Avail: NTIS MF $2.25; SOD HC $2.55 as I28.3:666 CSCL 07D

Chemical thermodynamic properties for the ideal gas state from 0 to 1500 K are tabulated for all of the alkane hydrocarbons through C10. These properties are based on correlations of the extant data for the entropy, vapor heat capacity, and enthalpy of formation of individual alkanes and the equilibrium constants of alkane isomerization reactions. Properties reported include the Gibbs energy function enthalpy function, enthalpy, entropy, heat capacity, enthalpy of formation, Gibbs energy of formation and the log of the equilibrium constant of formations. GRA

N74-34588# California Univ., Berkeley. Dept. of Chemistry.
CHEMICAL LASERS AND ULTRARAPID-SCAN INFRARED SPECTROSCOPIC STUDY OF TRANSIENT SPECIES Final Report
George C. Pimentel Jul. 1974 21 p refs
(Grant AF-AFOSR-1882-70; AF Proj. 9538)
(AD-783264; AFOSR-74-1232TR) Avail: NTIS CSCL 07/4

The unique capabilities of the Berkeley rapid-scan spectrometer have been applied to the study of a number of gaseous free radicals and the chemical laser frontier has been expanded. Most of the research effort has been directed toward the discovery of new chemical lasers, to the understanding of their operation, and to the extraction of reaction kinetic information from them. These kinetic studies are revealing the temperature dependence of vibrational excitation of reaction products, information not presently accessible by other experimental techniques. GRA

N74-34589# Aerospace Corp., El Segundo, Calif.
THEORETICAL AND EXPERIMENTAL (ELECTRON IMPACT) STUDIES OF LOW-LYING RYDBERG STATES IN O2 Interim Report
David C. Cartwright, William J. Hunt, Walter Williams, Sandor Trajmar, and William A. Goddard, III 15 May 1974 53 p refs
(Contract F04701-73-C-0074)
(AD-782487; TR-0074(9270-01)-8; SAMSO-TR-74-147) Avail: NTIS CSCL 07/4

Loss spectra have been correlated with the known behavior for transitions between electronic states of certain symmetry, and with the theoretical results, to identify the low-lying Rydberg states. Four vibrational levels of the (3 s sigma g) triplet Pig Rydberg state have been observed superposed on top of the maximum intensity portion of the Schumann-runge continuum. The theoretical results, combined with the energy-loss measurements and the high resolution photon absorption work, lead to the assignment of the lowest dipole-allowed Rydberg states. (Modified author abstract) GRA

N74-34590# Army Foreign Science and Technology Center, Charlottesville, Va.
STATE AND PROSPECTS FOR METALLIDE RESEARCH
I. I. Kornilov 20 Mar. 1974 16 p refs Transl. into ENGLISH from unidentified RUSSIAN language book, Moscow, 1971 p 246-257
(AD-781934; FSTC-HT-23-317-73) Avail: NTIS CSCL 07/2

The problem of formation of metallides, their classification and certain laws of formation are discussed in connection with the general questions of classification of inorganic compounds. Chemical bonding in intermetallics is also examined. GRA

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N74-34591 Pennsylvania Univ., Philadelphia.
ON ADAPTIVE EQUALIZERS FOR THE FADING DISPERSIVE COMMUNICATION CHANNEL AND THEIR DYNAMIC BEHAVIOR Ph.D. Thesis
Rifaat Aly Dayem 1974 213 p
Avail: Univ. Microfilms Order No. 74-22832

The polynomial equalizer, which is intended for applications were phase distortion is either negligible or unimportant was examined. A set of tones, strategically placed within the signal spectrum, is used to ascertain the distortion caused by the fading channel. The optimum locations of the tones are shown to be at the zeroes of a Chebyshev or a Legendre polynomial, depending on whether the minimax, or the minimum mean square error criterion is deemed more appropriate. The associated control parameters, and the resulting minimum error are related to the tone amplitudes by the Hilbert, and Vandermonde matrices. Other expansions of the channel transfer function, such as real exponentials in time, straight line segments in freqeuncy, Fourier series, and Bode bumps are briefly treated and compared to the polynomial expansion. The analysis of the behavior of the polynomial equalizer was investigated. Dissert. Abstr.

N74-34592 Colorado Univ., Boulder.
ELECTROMAGNETIC CHARACTERISTICS OF HORIZONTAL AND VERTICAL WIRES ABOVE A DISSIPATIVE EARTH Ph.D. Thesis
Robert Gerner Olsen 1974 213 p
Avail: Univ. Microfilms Order No. 74-22379

The problem of wave propagation along a thin wire above a conducting half-space was investigated, and the structure of the transverse fields in a plane transverse to the wire were examined in terms of two modes. The antenna problem, consisting of exciting the infinite wire with an arbitrary distribution of field along the axis of the wire, is also discussed. Reflection of current at the end of of a semi-infinite wire is solved, along with the wire excited by a homogenous plane wave with arbitrary incidence angle. A variational expression for the input impedance change of a vertical half wave dipole over a dissipative half-space was developed. Dissert. Abstr.

N74-34593# Japan Broadcasting Corp., Tokyo.
STILL PICTURE BROADCASTING SYSTEM
Yasutaka Numaguchi Jan. 1974 12 p refs
(NHK-Labs-Note-175) Avail: NTIS HC $4.00

Experimental broadcasting systems, still picture broadcasting systems, were developed and tested to establish technical feasibility of the service. Data cover technological problems of picture and sound transmission seperately or transmission of both simultaneously. It was concluded that in order for such systems to broadcast, it will be necessary to: (1) develop a technological system for program production, and (2) reduce the cost of the receiving memory. Data also show it will be necessary to clarify the social needs for such a service. E.H.W.

N74-34594# Lockheed Missiles and Space Co., Palo Alto, Calif.
SOME CHARACTERISTICS OF A PULSED PPI RADAR SIGNAL
M. I. Finkelshtein [1973] 9 p Transl. into ENGLISH from the

book "Osnovy Radiolokatsii" Moscow, Sovetskoe Radio, 1973 p 41-53
Avail: NTIS HC $4.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The characteristics of a pulse PPI radar signal are analyzed. Data cover: reflected signal structure at the receiver input, energy relations in the envelope, coherence of continuous oscillations, coherence and incoherence of radio pulses. E.H.W.

N74-34595*# Kanner (Leo) Associates, Redwood City, Calif.
USE OF SIMPLE TAPE RECORDERS FOR STORING DIGITALIZED ANALOG SIGNALS
S. Stots and M. Detterer Washington NASA Oct. 1974 17 p refs Transl. into ENGLISH from the German report Rept-7/73
(Contract NASw-2481)
(NASA-TT-F-15957; Rept-7/73) Avail: NTIS HC $4.00 CSCL 09B

A method for long-term storage of digitalized analog signals on simple audio tape recorders of the cassette type is described. It can be used for continuous analog signals, as they have high redundancy. On playback, recording errors can be detected and largely corrected. The readout of stored digital data can take place in digital form as well as in analog form after suitable conversion. At readout the faulty or erroneous data are marked and the number of errors counted. Author

N74-34596*# Kanner (Leo) Associates, Redwood City, Calif.
ENERGY FLOW IN ELECTROMAGNETIC WAVE FIELDS
H. Landstorfer, H. Liska, H. Meinke, and B. Muller Washington NASA Oct. 1974 20 p refs Transl. into ENGLISH from NTZ-Commun. Z. (West Germany), v. 25, no. 5, 1972 p 225-231.
(Contract NASw-2481)
(NASA-TT-F-15955) Avail: NTIS HC $4.00 CSCL 20N

Methods of calculating instantaneous and average energy flows and a newly defined concept of energy velocity are used in place of the conventional Maxwellian field strength method of characterizing the behavior of electromagnetic fields. The approach is applied to waveguides, providing an interpretation of dispersion and vortex phenomena, and to rod antennas, providing an interpretation of their near field patterns and effective areas. Author

N74-34597*# ITT Gilfillan, Inc., San Fernando, Calif.
ELECTRONIC SCHEMATICS FOR CONSTRUCTION AND TESTING OF A SCANNING LASER RADAR (SLR), APPENDIX Final Report
Terry Flom and H. Dean Coombes Dec. 1971 66 p
(Contract NAS8-20833)
(NASA-CR-123529) Avail: NTIS HC $6.50 CSCL 09C

The presented list of electrical engineering drawings ranges from the high frequency logistic acquisition counter and binary register to the target tracker power supply system. G.G.

N74-34598*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CHANNEL CODING AND DATA COMPRESSION SYSTEM CONSIDERATIONS FOR EFFICIENT COMMUNICATION OF PLANETARY IMAGING DATA
Robert F. Rice 1 Sep. 1974 130 p refs Revised
(Contract NAS7-100)
(NASA-CR-140181; JPL-TM-33-695-Rev-1) Avail: NTIS HC $9.50 CSCL 09F

End-to-end system considerations involving channel coding and data compression are reported which could drastically improve the efficiency in communicating pictorial information from future planetary spacecraft. In addition to presenting new and potentially significant system considerations, this report attempts to fill a need for a comprehensive tutorial which makes much of this very subject accessible to readers whose disciplines lie outside of communication theory. Author

N74-34599*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DEEP SPACE NETWORK Progress Report, Jul. - Aug. 1974
15 Oct. 1974 152 p refs
(Contract NAS7-100)
(NASA-CR-140514; JPL-PR-42-23) Avail: NTIS HC $5.00 CSCL 17B

The objectives, functions, and organization of the Deep Space Network are summarized. Deep space station, ground communication, and network operations control capabilities are described. Author

N74-34600*# Kanner (Leo) Associates, Redwood City, Calif.
PRINCIPLES OF TECHNICAL PLANNING FOR SATELLITE COMMUNICATIONS SYSTEMS
A. D. Fortushenko, G. B. Askinazi, V. L. Bukov, L. Ya. Kantor, and O. S. Krapotin Washington NASA Aug. 1974 373 p refs Transl. into ENGLISH of the book "Osnovy Tekhnicheskogo Proyektirovaniya Sistem Svyazi Cherez ISZ" Moscow, Svyaz Press, 1970
(Contract NASw-2481)
(NASA-TT-F-794) Avail: NTIS HC $21.75 CSCL 17B

The basic properties of satellite communications are described in terms of their significance and position among existing types of communications, organizational and technical principles of the construction of systems, problems of control of systems, problems related to the motion of satellites in orbit, and frequency ranges suitable for radio communications with satellites. Recommendations are presented for the performance factors and their basis is noted. A complete method is presented for calculating the signal power requirements of a communications system, and a method is developed for calculating the basic parameters of the high frequency links of a satellite communications line. Author

N74-34601# National Bureau of Standards, Boulder, Colo. Time and Frequency Div.
PRIMARY FREQUENCY STANDARDS Status Report
Helmut Hellwig Sep. 1973 16 p refs
(NBS Proj. 2730144)
(NBS-TN-646) Avail: SOD HC $0.30 as C13.46:646

The state-of-the-art in atomic frequency standards is surveyed with exclusive regard to their use as primary frequency reference; i.e., only accuracy is discussed. The report covers operational standards as well as devices which are still in the research or exploratory development phase. It is predicted that accuracies of better than 1 x 10 to the 13th power will be achieved within a few years, and that, as a consequence of new techniques, accuracy may be treated statistically in the not too distant future. Also, clocks may become available which remain accurate continually. Author

N74-34602# Research Inst. of National Defence, Stockholm (Sweden).
ASPECTS ON VISUAL COMMUNICATION AND THE FUTURE
Stephan Schwarz Mar. 1972 28 p refs Revised
(FOA-P-C-8316-M5-Rev) Avail: NTIS HC $4.50

Ideas from studies of the future are applied to visual communication. Systems structures for developing or restructuring the technologies for visual communication are suggested. Examples of psychological and socialogical problems are discussed. It is shown that systems that define policies for the development, and use of new technologies must be emphasized. Author

N74-34603*# Ohio State Univ., Columbus. ElectroScience Lab.
COMPUTER PROGRAM FOR THIN WIRE ANTENNA OVER A PERFECTLY CONDUCTING GROUND PLANE
J. H. Richmond Oct. 1974 46 p refs
(Grant NGL-36-008-138)
(NASA-CR-140622; ESL-2902-19) Avail: NTIS HC $5.50 CSCL 17B

A computer program is presented for a thin-wire antenna over a perfect ground plane. The analysis is performed in the frequency domain, and the exterior medium is free space. The antenna may have finite conductivity and lumped loads. The output data includes the current distribution, impedance, radiation efficiency, and gain. The program uses sinusoidal bases and Galerkin's method. Author

N74-34604*# Lockheed Electronics Co., Inc., Azusa, Calif. Industrial Technology Div.
LUNAR MODULE VOICE RECORDER Final Report
[1974] 35 p
(Contract NAS9-13644)

(NASA-CR-140305) Avail: NTIS HC $4.75 CSCL 14C

A feasibility unit suitable for use as a voice recorder on the space shuttle was developed. A modification, development, and test program is described. A LM-DSEA recorder was modified to achieve the following goals: (1) redesign case to allow in-flight cartridge change; (2) time code change from LM code to IRIG-B 100 pps code; (3) delete cold plate requirements (also requires deletion of long-term thermal vacuum operation at 0.00001 MMHg); (4) implement track sequence reset during cartridge change; (5) reduce record time per cartridge because of unavailability of LM thin-base tape; and (6) add an internal Vox key circuit to turn on/off transport and electronics with voice data input signal. The recorder was tested at both the LM and shuttle vibration levels. The modified recorder achieved the same level of flutter during vibration as the DSEA recorder prior to modification. Several improvements were made over the specification requirements. The high manufacturing cost is discussed. Author

N74-34605# International Centre for Theoretical Physics, Trieste (Italy).

MODELS OF EXTRAGALACTIC RADIO SOURCES WITH A CONTINUOUS ENERGY SUPPLY FROM A CENTRAL OBJECT

P. A. G. Scheuer Feb. 1974 45 p refs

(IC-74-6) Avail: AEC Depository Libraries

The dynamics of radio sources models are considered in which energy is carried from a nucleus to the radio components by a relativistic beam. Only a small fraction of the energy supply can be radiated away from the tip of the beam, and the rest lingers on in a cavity surrounding the beam. If the energy in the cavity contains both fast electrons and magnetic fields, then the cavity rather than the tip of the beam is likely to be the site for the greater part of the radio emission. When the lateral expansion of the cavity becomes subsonic, the outer parts of the cavity swell at the expense of the parts nearest the massive nucleus, where the thermal gas pressure is higher. Author

N74-34606# Marconi Space and Defence System Ltd., Stanmore (England).

A STUDY OF MICROWAVE COMMUNICATIONS FOR SCIENTIFIC SATELLITES. PART 2: S-BAND SPACE-BORNE TELEMETRY TRANSMITTERS

J. W. Carter and D. Maccoll Paris ESRO Apr. 1973 221 p refs

(Contract ESTEC-815/69)

(ESRO-CR-203-Pt-2) Avail: NTIS HC $14.25

The techniques for generating, modulating, and transmitting, an S-band phase or frequency-modulated telemetry signal are considered, excluding any multiplexing arrangements for combining the various baseband elements into a single communications signal. The techniques are comprehensively reviewed and compared and a preference indicated for particular transmitter designs. An analysis is made of the characteristics and performance of the various components available, or under development, and on the basis of this a suggestion is made for low power and high power transmitter designs. A design is proposed consisting of a UHF transistor amplifier followed by a varactor doubler or tripler which provides either a low power transmitter or the driver for a 30 watt TWT power amplifier. Author (ESRO)

N74-34607# Raytheon Co., Sudbury, Mass.

EVALUATION OF TWO DIMENSIONAL ADAPTIVE ANTENNA ARRAYS

George D. Thome and Roger L. StGermain Mar. 1974 19 p ref

(Contract F30602-73-C-0265; ARPA Order 2385)

(AD-782400; RADC-TR-74-186) Avail: NTIS CSCL 09/5

The objective of the research reported here is to evaluate the improvement in HF antenna array performance achievable through adaptive processing under actual field conditions, emphasizing two dimensional array geometries. The approach has been to collect experimental data under a variety of propagation conditions and evaluate the performance of the array with and without adaptive beamforming. A two-dimensional HF phased array facility had been established at Hudson, Colorado in connection with other ARPA programs and this facility was modified for adaptive data taking. The modification included the construction of 32 modular receivers and a 32 element cross array of vertical monopoles. Data were recorded on digital tape and processed off-line to produce sky maps (signal strength versus azimuth and elevation) in the full bandwidth of the receivers (17kHz). (Modified author abstract) GRA

N74-34608# Raytheon Co., Wayland, Mass. Advanced Development Lab.

MULTIPATH MEASUREMENTS Midterm Technical Report, 30 Apr. - 18 Jun. 1974

Alan H. Greene 21 Jun. 1974 44 p refs

(Contract DAAH01-74-C-0704; ARPA Order 2731)

(AD-782438; ER74-4221) Avail: NTIS CSCL 17/9

An outline of the final report to be issued during August 1974 is provided. Major topics to be covered are Multipath Theory, Experimental Measurements, Computer Simulation and Proposed Plans and Schedule for Phases 2 and 3. Included also is material presented at a recent Design Review which describes technical progress to date. Author (GRA)

N74-34609# United Aircraft Corp., East Hartford, Conn. Research Labs.

MASTER OSCILLATOR TECHNIQUES FOR 10 MICRON RADAR Final Technical Report, 25 Aug. 1972 - 24 Feb. 1974

A. Stein Apr. 1974 58 p refs

(Contract N00014-73-C-0086)

(AD-778369/9; UARL-N921512-8) Avail: NTIS HC $3.75 CSCL 17/8

The feasibility of using electro-optical coupling modulation of a CO2 waveguide laser to obtain a frequency chirped optical signal for application in 10 micron imaging radar is studied. This AM technique combines the advantage of a relatively high modulation efficiency with a wide bandwidth, independent of the gain profile and the free spectral range of the resonator. The use of a wideband waveguide system is for the purpose of displacing the oscillator spectrum relative to the active line of a postamplifier such that one chirped AM sideband is effectively isolated. (Modified author abstract) GRA

N74-34610# Goodyear Aerospace Corp., Litchfield Park, Ariz.

METRRA/FOLPES SIGNAL PROCESSOR AND SCAN CONVERTER Final Report

31 May 1974 55 p

(Contract DAAK02-73-C-0409)

(AD-782891; GERA-2002) Avail: NTIS CSCL 17/9

The objective of the effort was to design, develop, and fabricate hardware capable of processing coherent radar Metallic Reradiation Apparatus signals and displaying the resulting images on a standard color television monitor. The hardware is of a prototype nature and is usable under the Foliage Penetration System detection concept. (Modified author abstract) GRA

N74-34611# National Bureau of Standards, Boulder, Colo. Electromagnetics Div.

A STUDY OF THE MEASUREMENT OF G/T USING CASSIOPEIA A

D. F. Wait, M. Kanda, W. C. Daywitt, and C. K. S. Miller Jun. 1974 202 p refs Sponsored by Army Communications Command

(SCC Proj. 411-73)

(AD-783433; ACC-ACO-2-74) Avail: NTIS CSCL 17/2

The report describes a study intended to estimate the best possible accuracy of measuring the ratio G/T (System gain to system noise temperature) of a satellite communication ground station using the radio star Cassiopeia A (Cas A). The concept of G/T and its measurement using a radio star is briefly discussed. Results of an extensive literature search are presented, summarizing the properties of Cas A and its vicinity described by radio astronomers in order to utilize this information to assess the accuracy of a G/T measurement. (Modified author abstract) GRA

N74-34612# Naval Research Lab., Washington, D.C.

GEOMETRIC-OPTICS THEORY FOR COHERENT SCATTERING OF MICROWAVES FROM THE OCEAN SURFACE Final Report

Ronald M. Brown and Allen R. Miller 18 Jun. 1974 23 p

refs
(NRL Proj. R06-07B; RF12151401)
(AD-783038; NRL-7705) Avail: NTIS CSCL 20/14

The disagreement between theoretical and experimental values on the rough surface reflection coefficient for the coherent reflected field g = (sigma sub h sin psi) lambda greater than 0.1 radian is studied. It is shown that the coherent reflected field is given by R = exp ((-2(2 pi g) squared)) for 0 much smaller than g much smaller than 0.3 where I sub 0(x) is the modified Bessel function J sub 0(ix). This result is derived using geometric optics, assuming a spherical wavefront incident on a Gaussian collection of sinusoidal surface waves with uniform phase distribution. Further, R agrees with Beard's experimental curve, with a systematic difference in g of 10%. It is shown how R sub A is obtained, assuming a plane wavefront incident on a Gaussian collection of horizontal strips or equivalent simple functions. Author (GRA)

N74-34613# Office of Telecommunications, Boulder, Colo. Inst. for Telecommunication Sciences.
TEST INSTRUMENTATION FOR A 15 GHz DIGITAL RADIO LINK
C. A. Samson, L. G. Hause, J. E. Farrow, and R. E. Skerjanec Jul. 1974 29 p refs Sponsored by Army Communication Command
(ACC Proj. 405-74)
(AD-782966; ACC-ACO-6-74) Avail: NTIS CSCL 17/2

The report discusses requirements for test instrumentation to determine directly the relationship between the performance of 15 GHz digital radio links and the atmospheric environment. The methods of obtaining the required radio and meteorological information are outlined, electronic test instruments and recording configurations are described, and the advantages of a particular radio link for initial testing of 15 GHz systems in Germany are considered. Author (GRA)

N74-34614# Lincoln Lab., Mass. Inst. of Tech., Lexington.
MILLSTONE HILL RADAR PROPAGATION STUDY: SCIENTIFIC RESULTS, PART 2
John V. Evans 13 Nov. 1973 86 p refs Prepared in cooperation with Bell Telephone Labs., Inc., Whippany, N. J.
(Contracts F19628-73-C-0002; DAHC60-71-C-0005; DA Proj. 7X2-63304-D-614)
(AD-782748; TR-509) Avail: NTIS CSCL 17/9

Contents: Ionospheric scintillation; Traveling ionospheric disturbances. GRA

N74-34615# White Sands Missile Range, N.Mex. Telecommunications Group.
IRIG STANDARD PARALLEL BINARY TIME CODE FORMATS
1973 22 p
(AD-782702; TCG-128-73) Avail: NTIS CSCL 09/4

The need for time-of-year information with millisecond and microsecond resolution by data handling, processing and digital recording equipment makes the use of parallel binary time codes highly desirable. The intent of this document is to provide ground rules for maximum compatibility between present and future time generating equipment and the user interface. GRA

N74-34616# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STATISTICAL CHARACTERISTICS OF RADIO SIGNALS REFLECTED FROM THE EARTH'S SURFACE, SELECTED CHAPTERS
S. G. Zubkovich 14 Jun. 1974 211 p refs Transl. into ENGLISH from the book "Statisticheskie Kharakteristiki Radiosignalov, Otrazhennykh ot Zemnoi Poverkhnosti" Moscow, 1968 p 1-192, 218-223
(AD-783046; FTD-MT-24-780-74) Avail: NTIS CSCL 20/14

Contents: Reflection of radio waves from a plane surface; Reflection of radio waves from rough surfaces; Reflection of radio waves from surfaces with random roughnesses. Law of the distribution of reflected signals; Statistical characteristics of quadrature components of signals reflected from a randomly rough surface; Specific effective area of the reflection of statistically rough surfaces at sighting angles close to the vertical line; Statistical characteristics of the phase, amplitude and spectrum of the power of reflected signals when modulation of the radiated signal is absent; Statistical characteristics of some parameters of modulated signals reflected from a statistically rough surface. GRA

N74-34617# Harry Diamond Labs., Washington, D.C.
CIRCUITS FOR A PULSED DOPPLER RADAR
John Speulstra May 1974 31 p refs
(ARPA Order 1106)
(AD-783462; HDL-TM-74-8) Avail: NTIS CSCL 17/9

The report describes in detail the circuitry of a multirange-gate pulse Doppler radar which operates at 400 MHz. The system is a low power one that generates only a one-watt (peak) pulse of 50 ns length at a 40 kHz rate, for an average power of 2 mW. The receiver employs RF amplification, a wide-band video amplifier following the coherent mixer, a set of boxcars used as range gates, and active high-pass filters which are voltage adjustable. The timing circuit required is discussed. Author (GRA)

N74-34618# Air Force Weapons Lab., Kirtland AFB, N.Mex.
PROPAGATED EMP FROM TANGENT AND BURIED BURSTS Final Report, Mar. - Dec. 1973
James E. Brau, Gregory H. Canavan, Leon A. Wittwer, and Arthur E. Greene Jul. 1974 30 p refs
(AF Proj. 8809)
(AD-783246; AFWL-TR-74-47) Avail: NTIS CSCL 20/14

Calculations describing the ionospheric propagation of high-altitude electromagnetic pulses (EMP) to satellite altitudes are reported. Both tangent and buried burst scenarios are treated. The calculations are based on the AFWL CHEMP code for self-consistent calculations of radiated EMP, modified by the inclusion of a swarm treatment of secondary and ionospheric electrons. The region of applicability of this swarm treatment has been determined by a separate Monte Carlo calculation. By carrying the calculations all the way from the burst point through the E region, the authors are able to account fully for the D region heating, the increased absorption and cascading it produces, and the increased cutoff frequency which results. The code calculations are evaluated for sensitivity to the ambient ionospheres used. Author (GRA)

N74-34619# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ASYMPTOTIC SOLUTION TO THREE-DIMENSIONAL PROBLEM OF THE OBLIQUE INCIDENCE OF AN ELECTROMAGNETIC WAVE ON A CONVEX CYLINDER
N. S. Orlova 26 Jul. 1974 14 p refs Transl. into ENGLISH from Tr. Energ. Inst. (Moscow), no. 1, 1972 p 73-81
(FTD Proj. T74-02-16)
(AD-783448; FTD-HT-23-1449-74) Avail: NTIS CSCL 20/14

The diffraction field of a plane wave on the shaded portion of a cylinder was calculated using the approximate asymptotic method, in order to define elements which are related to the concept of enveloping waves. The results of calculation show that the proposed method of solving the electromagnetic diffraction problem for the case of a cylindrical surface of arbitary shape are applicable to diffraction currents on the surface, as well as for the dispersed field in the far zone. A.A.D.

N74-34620# Kaman Sciences Corp., Colorado Springs, Colo.
APERTURE COUPLING BY WIRE MESH MODELING
R. J. Spiegel 18 Mar. 1974 22 p refs
(Contract N00014-73-C-0215; NR Proj. 087-180)
(AD-778711; K-062-74-3(M)) Avail: NTIS CSCL 20/14

A method is presented whereby the near fields involving coupling through an aperture in a plane screen can be calculated. The technique uses Babinet's principle in which the aperture is replaced by a conducting plate. The plate is modeled by a wire mesh and the currents on the grid structure calculated by the method of moments. Numerical results are presented for both electrically small apertures and electrically larger cases in which the size of the aperture is on the order of the wavelength of the incident field. Computed results are compared with experimental measurements for a half wavelength by quarter wavelength rectangular aperture. Author (GRA)

N74-34621# Northeastern Univ., Boston, Mass. Electronics Research Lab.
TELEMETRY, RANGING AND INSTRUMENTATION SYSTEMS FOR SPACE VEHICLES Final Report, 1 Apr. 1971 - 31 Mar. 1974
J. Spencer Rochefort, Lawrence J. OConnor, Norman C. Poirier, and Robert E. Russell 30 Apr. 1974 74 p refs
(Contract F19628-71-C-0030; AF Proj. 7659)
(AD-783618; AFCRL-TR-74-0286) Avail: NTIS

The report summarizes the work carried under programs concerned with telemetry system studies, rocket and balloon instrumentation systems, tone-ranging system performance, evaluation of commercial telemetry system components, EMI testing of satellite components and field support of certain sounding rockets and balloons. Computer programs were developed to analyze performance of FDM/FM systems as well as commutator segment assignment. Effort in support of ICE CAP programs produced an inflight calibrator, a first motion switch, a tone-ranging system evaluation, and field support. The balloon support effort produced a special commutator/decommutator and an evaluation of subcarrier taper. A listing, only, is given of the various commercial telemetry components tested since detailed results are published in scientific reports which are available to authorized agencies. EMI testing procedures are developed for the S3 small satellite program. Finally, a tabulation is given of the field support rendered in connection with the various programs. Author (GRA)

N74-34622# TRW Systems Group, Redondo Beach, Calif.
CHARGE COUPLED DEVICES IN SIGNAL PROCESSING SYSTEMS. VOLUME 1: DIGITAL SIGNAL PROCESSING Final Report, Oct. 1973 - Apr. 1974
Thomas A. Zimmerman and Chauncey S. Miller Jul. 1974 145 p refs
(Contract N00014-74-C-0068)
(AD-782574) Avail: NTIS CSCL 09/5

The report summarizes the results of a study to determine the use of charge coupled devices (CCD's) in signal processing systems. This volume deals with digital CCD signal processing. Specific means of implementing digital functions with CCD's are described, and the range of applications is examined. It is concluded that digital CCD signal processing functions are feasible with today's technology, and that such functions are more easily programable and more widely applicable than analog functions. Specific examples are given in some detail, including a 16-bit arithmetic fast Fourier transform butterfly on a chip. Recommendations for future work are included. Author (GRA)

N74-34623# Naval Postgraduate School, Monterey, Calif.
EFFECTS OF ATMOSPHERIC TURBULENCE ON LASER COMMUNICATIONS M.S. Thesis
Thomas Prater Rankin Jun. 1974 49 p refs
(AD-783815) Avail: NTIS CSCL 17/2

A multiplicative model based on the amplitude modulation equation is developed to predict the phenomenon of frequency translation effects of atmospheric scintillation on AM laser communications. An experiment to measure the effects of scintillation on atmospheric laser communications is designed and built. Preliminary results of the experiment are in general agreement with the predictive model. The best agreement is in predicting the scintillation components present in the AM frequency spectrum with some questions raised about the ability of the model to predict the bandwidth of the translated scintillation noise. Author (GRA)

N74-34624# LTV Aerospace Corp., Dallas, Tex. Vought Systems Div.
FEASIBILITY DEMONSTRATION OF FIBER OPTICS AS APPLIED TO THE SOSTEL (SOLID STATE ELECTRIC LOGIC) DATA HANDLING SYSTEM Final Report, 27 Mar. 1973 - 9 Jan. 1974
Jim R. Perkins, Homer W. Heinzman, and W. Tom Turnage Jan. 1974 159 p refs
(Contract N62269-73-C-0411)
(AD-783918; Rept-2-57110/4R-3142) Avail: NTIS CSCL 17/2

The study was conducted to develop requirements and techniques for applying fiber optics to the solid state electric logic SOSTEL system in general and to develop a design for demonstrating the application of fiber optics to the SOSTEL 2 DHS brassboard system in specific. To achieve both objectives, an assessment was made of the characteristics of optical components as applicable to multiplex systems for military aircraft. Components evaluated include optical fibers, light sources, photodiodes, connectors, scramblers and tees. This assessment considered both functional and installation/environmental aspects. This foundation was then used to evolve a number of approaches for interconnection a multiplex system consisting of two processors and up to 32 remote terminals. The optimum approach was determined to be a radial system with passive branching devices. (Modified author abstract) GRA

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

N74-34625 Carnegie-Mellon Univ., Pittsburgh, Pa.
AN OPTICAL/DIGITAL PROCESSOR FOR DATA AND IMAGERY Ph.D. Thesis
Warren Martin Sterling 1974 207 p
Avail: Univ. Microfilms Order No. 74-19316

A hybrid optical/digital processor was constructed and its potential in various real-time coherent optical data processing applications demonstrated. The novel aspects of this processor are: (1) the input transducer, consisting of a real-time electrooptic Pockels effect light valve; and (2) an optical/digital interface for real-time output plane analysis. The interface was designed and implemented at the register transfer level using modular computer building blocks. A brief overview of the hybrid processor is presented, followed by a discussion of the processing requirements of the interface. The interface hardware and supporting software are then presented with a short introduction to the register transfer level of design and associated hardware components.
Dissert. Abstr.

N74-34626 Georgia Inst. of Tech., Atlanta.
COMPUTER-AIDED TOLERANCE ASSIGNMENT AND ANALYSIS Ph.D. Thesis
Shing Ted Li 1974 164 p
Avail: Univ. Microfilms Order No. 74-21571

It is necessary to select appropriate component tolerances, and to determine what percentage of manufactured products exhibit the desired performance, in designing electric circuit systems with lumped components, integrated circuits, and hybrid circuits. A general procedure is developed which treats tolerance assignment as a constrained optimization problem whereby system components can either be statistically independent or correlated. The Fiacco and McCormick method is employed in solving the constraind optimization problem. The problem is transformed into a sequence of uncontrained subproblems and is then solved with a Fletcher-Powell minimization technique. Tolerance assignment algorithms for two classes of distributions of component values are presented as examples of the general procedure. Monte Carlo tolerance analysis is used for determining the yield, and numerical examples are used to investigate the role of correlation coefficients in tolerance assignment and analysis. Dissert. Abstr.

N74-34627*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
MIDAS, PROTOTYPE MULTIVARIATE INTERACTIVE DIGITAL ANALYSIS SYSTEM, PHASE 1. VOLUME 1: SYSTEM DESCRIPTION Final Report, Oct. 1972 - Feb. 1974
F. J. Kriegler et al Aug. 1974 174 p refs
(Contract NAS1-11979)
(NASA-CR-132463; ERIM-195800-25-F) Avail: NTIS HC $11.75 CSCL 09B

The MIDAS System is described as a third-generation fast multispectral recognition system able to keep pace with the large quantity and high rates of data acquisition from present and projected sensors. A principal objective of the MIDAS program

is to provide a system well interfaced with the human operator and thus to obtain large overall reductions in turnaround time and significant gains in throughput. The hardware and software are described. The system contains a mini-computer to control the various high-speed processing elements in the data path, and a classifier which implements an all-digital prototype multivariate-Gaussian maximum likelihood decision algorithm operating at 200,000 pixels/sec. Sufficient hardware was developed to perform signature extraction from computer-compatible tapes, compute classifier coefficients, control the classifier operation, and diagnose operation. Author

N74-34628*# Lockheed Electronics Co., Houston, Tex.
SKYLAB S-191 SPECTROMETER SINGLE SPECTRAL SCAN ANALYSIS PROGRAM
E. L. Downes Sep. 1974 42 p ref
(Contract NAS9-12200)
(NASA-CR-140264; LEC-3246) Avail: NTIS HC $5.25 CSCL 09B

Documentation and user information for the S-191 single spectral scan analysis program are reported. A breakdown of the computational algorithms is supplied, followed by the program listing and examples of sample output. A copy of the flow chart which describes the driver routine in the body of the main program segment is included. Author

N74-34629# Joint Publications Research Service, Arlington, Va.
SYNTHESIS OF A NEW CLASS OF DECODERS FOR CYCLIC CODES
Yu. I. Volkov and F. E. Keller 24 Sep. 1974 14 p refs
Transl. into ENGLISH from Kibernetika (Moscow), no. 2, 1974 p 38-43
(JPRS-63043) Avail: NTIS HC $4.00

A description of decoders for cyclic codes built from controllable shift registers is given. Author

N74-34630# National Bureau of Standards, Washington, D.C. Systems and Software Div.
REPORT ON PLANNING SESSION ON SOFTWARE ENGINEERING HANDBOOK
Selden L. Stewart, ed. Nov. 1974 18 p
(NBS Proj. 6401129)
(NBS-TN-832; LC-74-600091) Avail: SOD HC $0.70 as C13.46:832

The need, coverage, and audience for a proposed software engineering handbook are discussed. Author

N74-34631*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CONTROL SYSTEM DESIGN USING FREQUENCY DOMAIN MODELS AND PARAMETER OPTIMIZATION, WITH APPLICATION TO SUPERSONIC INLET CONTROLS
Robert C. Seidel and Bruce Lehtinen Washington Oct. 1974 52 p refs
(NASA-TM-X-3108; E-7710) Avail: NTIS HC $3.75 CSCL 09B

A technique is described for designing feedback control systems using frequency domain models, a quadratic cost function, and a parameter optimization computer program. FORTRAN listings for the computer program are included. The approach is applied to the design of shock position controllers for a supersonic inlet. Deterministic or random system disturbances, and the presence of random measurement noise are considered. The cost function minimization is formulated in the time domain, but the problem solution is obtained using a frequency domain system description. A scaled and constrained conjugate gradient algorithm is used for the minimization. The approach to a supersonic inlet included the calculations of the optimal proportional-plus integral (PI) and proportional-plus-integral-plus-derivative controllers. A single-loop PI controller was the most desirable of the designs considered. Author

N74-34632# New York Univ., N.Y. Center for Interdisciplinary Programs.
COMPUTER EDGE EXTRACTION FROM PHOTOGRAPHS OF CURVED OBJECTS Interim Report
E. Urs Ramer Dec. 1973 155 p refs
(Grant AF-AFOSR-1854-70)
(AD-778456/4; CRL-34; AFOSR-74-0625TR) Avail: NTIS HC $5.00 CSCL 09/2

There is much current interest in the subject of scene analysis, the recognition of objects in photographic images. One way of recognizing objects is in terms of their shapes. Convenient means for representing shapes are provided by line structures. The research described here is concerned with the extraction of two dimensional line structures from real photographs of both flat faced and curved, three dimensional objects. A new procedure for the edge detection is described. (Modified author abstract) GRA

N74-34633# Pennsylvania Univ., Philadelphia. Dept. of Decision Sciences Management.
ISSUES INVOLVED IN IMPLEMENTING A DATA PROCESSING SYSTEM ON A MINICOMPUTER Final Report
Ronald Barry Freeman 1974 231 p
(Contract N00014-67-A-0216-0007; NR Proj. 049-272)
(AD-782250) Avail: NTIS CSCL 09/2

In order to better understand what is involved in implementing a data processing system on a minicomputer, it is helpful to investigate and examine many key issues. These issues may be classified into software, hardware, and human factors considerations. Various tradeoffs and questions are analyzed, and possible compromises and solutions are offered. As an appendix, the thesis includes an instruction manual of a data processing system designed by the author for the U. S. Navy. This particular system automates logistics control and report-generating functions of the Supply Department for many Navy ships. As such, it exemplifies the use of minicomputers for data processing systems. Additionally, two other appendices include (1) a listing of the above mentioned computer program and (2) its flow chart. Author (GRA)

N74-34634# Utah Univ., Salt Lake City.
MAN-MACHINE COMMUNICATIONS Final Report, 1 Jul. 1970 - 1 Oct. 1973
Thomas Stockham, Jr. and Murray Kesselman Oct. 1973 116 p refs
(Contract F30602-70-C-0300)
(AD-782444; RADC-TR-74-97) Avail: NTIS CSCL 09/2

The objective of the research effort reported herein was the development of computers and computing techniques that aid people in some areas not traditionally subject to the application of computers. The computer graphics effort has developed computing techniques and original computer components to accomplish the realistic display of mathematically described three-dimensional objects. The waveform processing effort has used a digital computer not only for direct results in the form of processed images and audio waveforms, but also for the simulation of new techniques (e.g., vocoding) which show promise of relatively inexpensive implementation in special purpose hardware. The symbolic computation effort has produced and is continuing to improve, maintain and distribute a programming language and subsystem, REDUCE. GRA

N74-34635# University of Southern Calif., Los Angeles. School of Engineering.
COMPUTER PERFORMANCE EVALUATION Final Report, 1 Jan. - 31 Dec. 1973
Bennet P. Lientz Jan. 1974 14 p
(Contract N00014-67-A-0269-0027; NR Proj. 049-345)
(AD-782243) Avail: NTIS CSCL 09/2

The report summarizes the work and progress under the contract. During this period the following technical reports were prepared: Experiments in communication networks; Systems analysis in military communication networks; Selecting a process monitor schedule with multiple resource constraints; Trade-offs between local and remote computing; and, Computer network usage - cost/benefit analysis. GRA

N74-34636# Maryland Univ., College Park. Computer Science Center.
PATTERN RECOGNITION Interim Report
Laveen N. Kanal and Ashok K. Agrawala Oct. 1973 43 p refs
(Grant AF-AFOSR-1982-71; AF Proj. 9769)

(AD-778940; TR-264; AFOSR-74-0631TR) Avail: NTIS CSCL 09/2

A tutorial introductory article on the current status of pattern recognition methodology and its applications is reported.

Author (GRA)

N74-34637# Defense Systems Management School, Fort Belvoir, Va.

PROCEEDINGS OF THE 15TH SYMPOSIUM ON INTERACTIVE COMPUTER GRAPHICS FOR PROJECT MANAGERS

Charles H. Smith, II Dec. 1973 185 p refs Symp. held at Ft. Belvoir Va., 10-11 Oct. 1973

(AD-780810) Avail: NTIS CSCL 09/2

The report is the collected papers of the first Interactive Computer Graphics Symposium for Project Management sponsored by the Defense Systems Management School, 10-11 October 1973 at Fort Belvoir. The purpose of the symposium was to bring together experts in the field of interactive computer graphics and Department of Defense project managers to exchange knowledge about the capabilities and problems which need solutions. GRA

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N74-34638* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

INTEGRATED P-CHANNEL MOS GYRATOR Patent

Erwin S. Hochmair, inventor (to NASA) (NAS-NRC) Issued 8 Oct. 1974 7 p Filed 2 Feb. 1973 Supersedes N73-18224 11 - 09, p 1008) Sponsored by NASA

(NASA-Case-MFS-22343-1; US-Patent-3,840,829; US-Patent-Appl-SN-329237; US-Patent-Class-307-295; US-Patent-Class-307-304; US-Patent-Class-307-18; US-Patent-Class-307-35) Avail: US Patent Office CSCL 09B

A gyrator circuit is described which is of the conventional configuration of two amplifiers in a circular loop, one producing zero phase shift and the other producing 180 phase reversal, in a circuit having medium Q composed of all field effect transistors of the same conductivity type. The current source to each gyrator amplifier comprises an amplifier which responds to changes in current, with the amplified signals feed back so as to limit current. The feedback amplifier has a large capacitor connected to bypass high frequency components, thereby stabilizing the output. The design makes possible fabrication of circuits with transistors of only one conductivity type, providing economies in manufacture and use. Official Gazette of the U.S. Patent Office

N74-34639 Polytechnic Inst. of Brooklyn, N.Y.

INVESTIGATION OF PERIODICALLY-MODULATED SLOW-WAVE FREQUENCY SCANNING ANTENNAS Ph.D. Thesis

Boaz Gelernter 1974 170 p

Avail: Univ. Microfilms Order No. 74-22471

The class of traveling wave antennas meeting the following requirements was investigated: (1) each structure employs a feedguide completely filled with high dielectric constant material to produce a slow basic wave in the guide, (2) radiating, transverse, periodic slots are coupled to the feed via branchguides at periodic intervals along the feedguide axis, and (3) periodicity and other feed parameters are selected to produce a single leaky Floquet space-harmonic within the operating band. It was predicted that compact, flat structures of this type would be capable of wide-angle beam scanning by frequency variation, similar to heavier and more complex serpentine arrays. Various other structures including a slit loaded parallel dielectric filled parallel plate guide structure, a slot array bounded by E-plane walls, and flush mountable structures were also investigated.

Dissert. Abstr.

N74-34640 Virginia Univ., Charlottesville.

THE MEASUREMENT OF POSITION, BASELINE, AND TIME USING 4-ANTENNA INTERFEROMETRY Ph.D. Thesis

Paul Derek Hemenway 1974 101 p

Avail: Univ. Microfilms Order No. 74-23252

Dual baseline interferometry provides a method of eliminating local oscillator instability problems in phase measurements. The technique of four-antenna very long baseline interferometry is developed by using a vector formalism to derive the basic equations necessary to solve for position and baseline corrections. A graphical comparison technique is developed to determine differentially variations of the earth's rotation. The Mark II VLB system of the National Radio Astronomy Observatory is described with some emphasis on the phase handling aspects of the equipment. The application to the 4-antenna experiment is then discussed. Observations made on two 48 hours runs are described. The reductions follow the procedures outlined. Dissert. Abstr.

N74-34641*# Sense Systems Co., Temple City, Calif.

A STUDY PROGRAM ON LARGE APERTURE ELECTRONIC SCANNING PHASED ARRAY ANTENNAS FOR THE SHUTTLE IMAGING MICROWAVE SYSTEM Final Report

Jun. 1974 158 p refs Prepared for JPL

(Contracts NAS7-100; JPL-953921)

(NASA-CR-140576; FR-104) Avail: NTIS HC $11.00 CSCL 09E

Fundamental phased array theory and performance parameters are discussed in terms of their application to microwave radiometry, and four scanning phased arrays representing current examples of state-of-the-art phased array technology are evaluated for potential use as components of the multispectral antenna system for the space shuttle imaging microwave system (SIMS). A discussion of problem areas, both in performance and fabrication is included, with extrapolations of performance characteristics for phased array antennas of increased sizes up to 20 m by 20 m. The possibility of interlacing two or more phased arrays to achieve a multifrequency aperture is considered, and, finally, a specific antenna system is recommended for use with SIMS.

Author

N74-34642*# Scientific Translation Service, Santa Barbara, Calif.

THE 2.2 mm WAVELENGTH FREQUENCY CONVERTER

Yu Khapin, B. Washington NASA Oct. 1974 11 p refs Transl. into ENGLISH of Acad. of Sci. USSR, Preprint 166 (Moscow), 1974 16 p

(Contract NASw-2483)

(NASA-TT-F-15964) Avail: NTIS HC $4.00 CSCL 09C

The results of a theoretical and experimental study of a 2.2 mm wavelength frequency converter are given. A Schottky barrier diode is used as the nonlinear element. The frequency converter conversion losses are 9 db in the wideband regime. The relative noise temperature is 1.2. Author

N74-34643*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

TEMPERATURE RISE OF FLAT CONDUCTOR CABLE INSTALLED UNDER CARPET

James D. Hankins Sep. 1974 13 p refs

(NASA-TM-X-64883) Avail: NTIS HC $3.00 CSCL 09C

The method, test data, and results of temperature rise tests are reported on flat conductor cable installed under carpet and powered at up to twice rated loads. Author

N74-34644*# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.

POWER CONVERSION IN ELECTRICAL NETWORKS

Jonathan Rotherham Wood Jun. 1974 182 p refs

(Grant NGR-22-007-172)

(NASA-CR-120830) Avail: NTIS HC $2.25 CSCL 09C

Aspects of dc to dc conversion were studied in terms of a class of switching voltage regulators from a stability viewpoint. Background concepts of nonlinear system theory were considered, including the problem of obtaining suitable realizations for a class of positive operators. It is shown that the state evolution equations for a power conversion network are in general of bilinear form, and that the theory of lie groups and lie algebras is useful in analyzing such systems. The feedback stabilization of a class of bilinear systems whose state space is a manifold is also discussed. Author

N74-34645*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SURFACE-MOUNTED FLAT CONDUCTOR CABLE FOR HOME WIRING
James D. Hankins and James R. Carden Aug. 1974 21 p
(NASA-TM-X-64887) Avail: NTIS HC $3.00 CSCL 09A

The concepts are discussed which are being considered and developed for surface-mounted wiring using flat conductor cable. Safety aspects, problems being encountered, and advantages are also discussed. Author

N74-34646*# Scientific Translation Service, Santa Barbara, Calif.
EXPERIMENTAL DETECTION OF THE TWO ELEMENTARY TYPES OF ENERGY VORTICES IN WAVE FIELDS
H. Liska and H. H. Meinke Washington NASA Oct. 1974 14 p refs Transl. into ENGLISH from NTZ-Nachrtech. Z (West Germany), v. 23, no. 9, 1970 p 445-448
(Contract NASw-2483)
(NASA-TT-F-15956) Avail: NTIS HC $4.00 CSCL 09C

The first type of energy vortex is detected experimentally by measurement with an electric probe of the amplitude and phase of the electric field strength along the margin of the midplane. This shows an increasingly retarded phase along line 1 and a partially increasing curve along line 2. This is distinctive behavior of a simple vortex. The second type is experimentally detected in a similar manner, with data obtained directly from the upper surface. The amplitude distribution is more complicated, and the vortex center is most simply observed as the intersection point of the phase lines. Author

N74-34647*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AIRCRAFT MOUNTED CRASH ACTIVATED TRANSMITTER DEVICE Patent Application
Robert Manoli (Rockwell Intern. Corp.) and Bertram R. Ulrich, inventors (to NASA) (Rockwell Intern. Corp.) Filed 3 Oct. 1974 18 p Sponsored by NASA
(NASA-Case-MFS-16609-3; US-Patent-Appl-SN-511894) Avail: NTIS HC $4.00 CSCL 09E

An aircraft crash location transmitting device is described that automatically ejects from an aircraft at the time of a crash and starts transmitting signals automatically. NASA

N74-34648*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RECOMMENDED PRACTICES FOR ENCAPSULATING HIGH VOLTAGE ASSEMBLIES
E. W. Tankisley Aug. 1974 15 p
(NASA-TM-X-70757; X-752-74-247) Avail: NTIS HC $4.00 CSCL 09C

Preparation and encapsulation of high voltage assemblies are considered. Related problems in encapsulating are brought out in these instructions. A test sampling of four frequently used encapsulating compounds is shown in table form. The purpose of this table is to give a general idea of the working time available and the size of the container required for mixing and de-aerating. Author

N74-34649*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TWO FEED DISH ANTENNA HAVING SWITCHABLE BEAMWIDTH Patent Application
Richard F. Schmidt, inventor (to NASA) Filed 4 Oct. 1974 17 p
(NASA-Case-GSC-11968-1; US-Patent-Appl-SN-512825) Avail: NTIS HC $4.00 CSCL 09E

A switchable beamwidth antenna includes a concave parabolic main reflecting dish which has a central circular region and a surrounding coaxial annular region. A feed means selectively excites only the central region of the main dish via a truncated subreflector for wide beamwidth or substantially the entire main dish for narrow beamwidth. The feed means comprises a truncated concave ellipsoid subreflector and separate feed terminations located at two foci of the ellipsoid. One feed termination directly views all of the main dish while the other feed termination, exciting the main dish via the subreflector, excites only the central region because of the subreflector truncation. NASA

N74-34650# Commissariat a l'Energie Atomique, Grenoble (France).
STUDY AND FABRICATION OF TUNNEL DIODES MADE ON GERMANIUM USING A COLLECTIVE PLANAR TECHNIQUE Ph.D. Thesis - Univ. Scientifique et Medicale de Grenoble
M. Vrahides Mar. 1974 80 p refs In FRENCH
(CEA-R-4509) Avail: AEC Depository Libraries HC $7.00

A study was made of the collective process used to fabricate tunnel diodes on germanium with a time variance of 0 to 5 ns. After giving the essential results of the theory of tunnel diodes, a list is given on the constraints of the fabrication process. A detailed account was also given of the technological process and materials used in the process. Experimental results and possible improvements in diode performance are discussed. Transl. by E.H.W.

N74-34651# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
AN EIGHT-ELEMENT SHORT-BACKFIRE FAN-BEAM ARRAY
Hermann W. Ehrenspeck and John A. Strom 4 Mar. 1974 40 p refs
(AF Proj. 4600)
(AD-782022; AFCRL-PSRP-589; AFCRL-TR-74-0115) Avail: NTIS CSCL 09/5

Eight short backfire (SBF) elements aligned on a common planar reflector form a highly efficient fan-beam array capable of yielding a maximum gain of approximately 24 db. The influence of parameter variations on the array patterns and directivity was experimentally determined by varying the frequency. Normalized design parameters for highest efficiency and for circular polarization capability are tabulated. All array dimensions are given in wavelengths so that each application can easily be scaled for any desired frequency. Author (GRA)

N74-34652# Ohio State Univ., Columbus. ElectroScience Lab.
ADAPTIVE ANTENNA ARRAYS FOR CODED COMMUNICATIONS SYSTEMS
K. L. Reinhard May 1974 223 p refs
(Contract F30602-72-C-0162)
(AD-782395; OSURF-3364-2; RADC-TR-74-102) Avail: NTIS CSCL 17/2

An adaptive antenna array suitable for rejecting undesired signals in a coded, digital communication system is described. The signal received by each array element is adjusted in amplitude and phase by an adaptive, feedback-control system designed to minimize the mean-square error between the array output and a reference signal. The received signal at the array output is waveform-processed to generate the required reference signal. This approach permits array adaption to occur simultaneously with data reception since the derived-reference signal contains an estimate of the unknown data modulation. Moreover, the allocation of transmitter power exclusively for the purpose of array pattern control is avoided. (Modified author abstract) GRA

N74-34653# Raytheon Co., Bedford, Mass. Missile Systems Div.
SCATTERING FROM DIELECTRIC-COVERED PERIODIC SCREENS OF SMALL RECTANGULAR APERTURES
Quirino Balzano, Lawrence R. Lewis, and Jerome Pozgay Mar. 1974 52 p refs
(Contract F19628-72-C-0202; AF Proj. 4600)
(AD-782027; BR7997; AFCRL-TR-74-0173; SR-2) Avail: NTIS CSCL 09/5

A study of the use of perforated screens as potential radome structures was conducted. The self-complementary nature of these screens suggests their application for broadbanding or harmonic filters, while aiding the structural integrity of the radome. The adjustment of radome parameters is important to the control of wide angle radiation from radome-covered conformal arrays. The analysis of plane wave scattering by infinitesimally thin periodic screens of rectangular apertures is developed and applied to the scattering by dielectric slab-covered self-complementary screens. (Modified author abstract) GRA

N74-34654# Hercules Powder Co., Magna, Utah. Bacchus Works.
DESCRIPTION, PRINCIPALS OF OPERATION, FABRICATION, INSTRUCTIONS, AND MAINTENANCE AND CALIBRATION INSTRUCTIONS, PEAK FOLLOWER CIRCUIT
D. U. Bennion 1 Apr. 1974 62 p
(Contract F04611-73-C-0065)
(AD-783358) Avail: NTIS CSCL 09/5

The manual describes the operation, fabrication, maintenance, and calibration of the peak follower circuit (PFC). The PFC is an electronic instrument designed to simplify the reduction of T-burner data by converting acoustic pressure input into two output signals: PFC output and log amplifier output. The PFC consists of two separate modules. The first module consists of an absolute value circuit, a low-gain amplifier, and a log amplifier. The second module consists of a variable frequency low-pass filter. The PFC output signal is proportional to the envelope of the absolute value of the input signal. The log amplifier output signal is proportional to the logarithm of the PFC output signal. Author (GRA)

N74-34655# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDY OF FILM STRUCTURE ON A COMMUTATOR FORMED BY BRUSHES OF NIOBIUM-DISELENIDE-GRAPHITE COMPOSITION
V. L. Kalikhman, A. G. Duksina, V. S. Titov, and E. B. Granovskii 24 Jun. 1974 9 p refs Transl. into ENGLISH from Elektrotekhnika (USSR), no. 1, 1973 p 41-42
(AD-782553; FTD-HT-23-1146-74) Avail: NTIS CSCL 09/1

Methods of electron microscopy and microdiffraction are used to study a film of polish formed on a short-circuited M-1 copper commutator by brushes of niobium-diselenide-graphite composition. Author (GRA)

N74-34656# Physical Electronics Labs., Menlo Park, Calif.
BROADBAND FERRITE LIMITERS Semiannual Report, Jul. 1973 - Jan. 1974
S. S. Elliott, Sidney T. K. Nieh, and O. Wetterhorn Jun. 1974 34 p refs
(Contract DAAB07-72-C-0305; DA Proj. 1S0-62102-A-042)
(AD-782237; ECOM-72-0305-3) Avail: NTIS CSCL 09/1

The objective of this program is the development of wideband limiters in the frequency ranges of 12 to 14 GHz and 14 to 16 GHz. The report discusses theoretical and experimental investigations to design and build frequency selective ferrite power limiters with given technical specifications. GRA

N74-34657# Army Electronics Command, Fort Monmouth, N.J.
STORAGE CAMERA TUBE WITH NONDESTRUCTIVE READOUT Quarterly Report, 1 Jan. - 31 Mar. 1974
L. S. Yaggy Jun. 1974 20 p Prepared by Hughes Aircraft Co., Carlsbad, Calif.
(Contract DAAB07-73-C-0330)
(AD-782235; ECOM-73-0330-3; QR-3) Avail: NTIS CSCL 09/1

The report describes the progress that occurred during the third quarter of a Research and Development Contract to develop a novel camera-tube capable of dual-mode operation, either as a real-time television camera-tube or as a storage camera-tube with non-destructive readout, switchable upon command. Initial lots of targets were fabricated using the higher density masks, which provide 2000 diodes per inch, and data relating storage-characteristics with diode-array geometry have been accumulated. Results of additional measurements of sensitivity at 0.8 micrometer and 1.06 micrometer are discussed. Electron-energy-distribution measurements mode on an electron gun of latest design confirm the superiority of the no-crossover mode of operation for non-destructive reading of the storage camera-tube target. (Modified author abstract) GRA

N74-34658# Watkins-Johnson Co., Palo Alto, Calif.
ELECTRON BEAM SEMICONDUCTOR HIGH CURRENT VIDEO PULSER Final Report, 23 Jan. 1973 - 22 Jan. 1974
Richard I. Knight and Bruce W. Bell Jun. 1974 17 p
(Contract DAAB07-73-C-0090; DA Proj. 1S7-62705-A-H94)
(AD-783435; W-J-22-4111-F; ECOM-73-0090-F) Avail: NTIS CSCL 09/5

Ten EBS high current pulse amplifiers were fabricated, tested, and delivered to ECOM for life testing. The diodes used in these devices had an active area of 0.35 sq cm and were fabricated with an integral gold beam shield over the junction boundary to prevent diode reverse breakdown degradation due to beam illumination. The diodes were mounted on BeO substrates in order to be able to X-ray and evaluate the diode to substrate bond. Each of the devices was tested at approximately 40 A peak output into a 1 ohm load with a pulse risetime of 3 nanoseconds. Author (GRA)

N74-34659# GTE Sylvania, Inc., Mountain View, Calif. Electronic Systems Group.
HIGH PRESSURE TRANSDUCER
G. Kirby Miller 15 Jun. 1974 107 p
(Contract N00014-72-C-0307)
(AD-782281; TR-3) Avail: NTIS CSCL 09/1

The primary purpose of the study is to measure and evaluate the performance of an electret coaxial cable transducer as a hydrophone. This includes any possible environmental effects on performance such might be caused by depth pressure, temperature, and motion-caused turbulence. GRA

N74-34660# Westinghouse Research Labs., Pittsburgh, Pa.
FERROELECTRIC DISPLAYS Final Report, 16 Apr. - 30 Nov. 1972
M. H. Francombe, S. Y. Wu, and W. J. Takei May 1974 84 p refs
(Contract N00014-71-C-0268; NR Proj. 215-180)
(AD-781950) Avail: NTIS CSCL 09/5

Efforts were continued to explore the feasibility of making ferroelectric optical displays from lanthanum-doped lead zirconate titanate (PLZT) and from epitaxial films of bismuth titanate ($Bi_4Ti_3O_{12}$). PLZT showed good switching speed but device evaluation was hampered by the poor quality of commercially available material. Progress was made in fabricating a matrix-addressed bismuth titanate display with good contrast and retentivity but problems resulted from the stress exerted by the substrate. Solutions are presented for the problems encountered in both materials. (Modified author abstract) GRA

N74-34661# TRW, Inc., Lawndale, Calif. Semiconductor Div.
PRODUCTION ENGINEERING MEASURE FOR AN INTEGRATED CIRCUIT POWER AMPLIFIER 600-1000 MHz FOR TACTICAL RADIO EQUIPMENT Quarterly Report, 1 Jan. - 31 Mar. 1974
Roger C. DeBloois Mar. 1974 18 p
(Contract DAAB05-72-C-5844)
(AD-782865; QR-8) Avail: NTIS CSCL 09/5

The project is intended to provide for production engineering to manufacture an amplifier with the following characteristics: 30 watts output power; input impedance, 50 ohms; output impedance, 50 ohms; frequency band, 600-1000 MHz. The amplifier will use the TRW MICroAMP broadband transistor which will be optimized as part of this project. Two of these devices will then be combined using 90 degree interdigitated couplers to produce a minimum of 30 watts of power. This amplifier will be adaptable for use as a building block for the fabrication of higher power systems. Fifteen preproduction amplifiers were built and partially tested. (Modified author abstract) GRA

N74-34662# Purdue Univ., Lafayette, Ind. School of Engineering.
THERMOPHOTOVOLTAIC CELLS Final Report, Jun. 1972 - Dec. 1973
R. J. Schwartz, N. F. Gardner, Michael Lammert, and Philip Munro Jun. 1974 79 p refs
(Contract DAAB07-72-C-0281; DA Proj. 1T0-61102-A-34A)
(AD-782833; ECOM-72-0281-72-F) Avail: NTIS CSCL 09/1

In this report the fabrication, testing, and test results obtained on a germanium PIN Photovoltaic cell intended for use in a thermophotovoltaic energy conversion system are described. The cells were tested using a tungsten source with a spectral distribution approaching that of a 3220K black body. Conversion efficiencies as high as 11.72% were observed. The performance of these cells was measured at radiation intensities as high as 10 watts/ sq. cm. and the performance of the cells

was observed to be continuously improving as the radiation intensity increased. The open circuit voltage which was observed in these devices was lower than previously computed. The causes of the lower than expected open circuit voltage were determined to be the device thickness, which was larger than optimum for the radiation source, and the presence of a surface recombination which increased at high radiation intensity levels. Heat sink performance tests indicate that the device can be adequately heat sinked for operation at radiation intensities in excess of 10 watts/sq. cm. Recommendations for future work on these devices are also presented. Author (GRA)

N74-34663# Northrop Corp., Palos Verdes Peninsula, Calif. Electronics Div.
BOND IMPROVEMENT PROGRAM FOR HARRY DIAMOND LABORATORIES Final Technical Report, 1 May - 1 Dec. 1973
Peter G. Sutherland, Boyce T. Ahlport, and Vincent DeMartino 1 Dec. 1973 70 p refs
(Contract DAAG39-73-C-0127)
(AD-782886; NORT-73-309-A; HDL-127-1) Avail: NTIS CSCL 09/5

The report covers work to improve Northrop's Nickel Beam Lead Interconnect Packaging (abbreviated as BLH for Beam Lead Hybrids in this report) materials and processing for radiation hardening. The major effort in the work established process controls, monitoring techniques and production screening techniques for BLH die attach and beam bond processes. Discrete resistor substrate materials and epoxies for component mounting were evaluated for BLH processing compatibility and radiation hardening. Component mounting techniques were improved to obtain repeatable, void-free component attachment for LSI devices. The basic bonding and material parameters for nickel beam leads were studied and a model for the ultrasonic bonding of nickel beam leads is presented, using bond monitor equipment data, bond strength data and scanning electron microscope photography. Nickel beam bond strength is established as 3 to 5 times greater than conventional flying wire. Repeatable results are achieved with the use of process controls such as bond monitoring, bond schedule optimization, material parameter control, thermal-mechanical screening and 100% nondestructive beam bond pull testing. (Modified author abstract) GRA

N74-34664# Silicon Transistor Corp., Chelmsford, Mass.
PRODUCTION ENGINEERING MEASURE FOR HIGH CURRENT, FAST-SWITCHING TRANSISTORS Quarterly Progress Report, 19 Jan. - 19 Apr. 1974
Frederick G. Ernick May 1974 36 p
(Contract DAAB05-73-C-0232)
(AD-782848; QPR-5) Avail: NTIS CSCL 09/1

The second set of engineering samples was approved. It was decided to fabricate the First Article Samples in both the JEDEC TO-36 and TO-115 packages because of the desirability of both the single and double-ended versions of this device for circuits applications. The SCS-450-A, showing the electrical and physical parameters of both versions of the subject transistors, is shown as is the first article testing procedure. Permission to start fabrication of the First Article Samples was obtained and actual device fabrication was begun. Author (GRA)

N74-34665# Texas Instruments, Inc., Dallas. Central Research Labs.
TUNABLE FILTERS USING CHARGE TRANSFER DEVICES Interim Technical Report, 16 Jul. 1973 - 16 Mar. 1974
D. D. Buss and C. R. Hewes Jun. 1974 35 p refs
(Contract DAAB07-73-C-0266; DA Proj. 1S6-62705-A-057)
(AD-782818; ECOM-73-0266-1; TI-08-74-30; ITR-16) Avail: NTIS CSCL 09/5

Design approaches for CCD tunable bandpass filters include: (1) Two 500 stage filters with about 40 db sidelobes and a 1% 3db bandwidth; (2) a 403 stage filter with 35 db sidelobes and 1.25% bandwidth; (3) a 403 stage filter with 55 db sidelobes and 1.40% bandwidth; and (4) a pair of 250 stage multiplexed filters which simulate a 500 stage device with 1% bandwidth and 35 db sidelobes. The Dolph-Chebyshev tap weighting technique is described. Computer simulations show that sidelobe rejection of 40 db can be achieved with charge transfer efficiency CTE greater than or equal to 0.999, which has been achieved in buried channel CCD's up to 40 MHz. Noise limitations are calculated and an on-chip input amplifier is described. Experimental results are presented from a 101 stage filter designed for 29 db sidelobes and 4% bandwidth. Author (GRA)

N74-34666# Army Foreign Science and Technology Center, Charlottesville, Va.
APPLICATION OF POLYMER SEMICONDUCTORS IN ELECTRONICS AND AUTOMATION
Ya. M. Paushkin 6 May 1974 32 p refs Transl. into ENGLISH from the book "Organicheskie Polimerye Poluprovodniki" Moscow, 1971 p 211-223
(AD-783836; FSTC-HT-23-1969-73) Avail: NTIS CSCL 09/1

The report describes characteristics and applications of polymer semiconductors in industry and electronics. Their response and use as thermally controlled resistors are discussed, as well as volt-ampere characteristics and strain gage applications. GRA

N74-34667# Princeton Univ., N.J. Device Physics Lab.
STUDY OF ELECTRONIC TRANSPORT AND BREAKDOWN IN THIN INSULATING FILMS Semiannual Technical Report
Walter C. Johnson, Murray A. Lampert, and Wilmer R. Bottoms Jan. 1974 24 p refs
(Contract F19628-72-C-0298; ARPA Order 2180)
(AD-783870; PU-DPL-TR-28; AFCRL-TR-74-0229; SATR-3) Avail: NTIS CSCL 09/1

This report reviews progress in a comprehensive research program directed toward a basic understanding of electronic transport, charge trapping, and dielectric breakdown in the thin insulating films used in integrated circuits. Research is reported in the following areas: Corona-induced nondestructive breakdown in insulating films; Self-quenched breakdown of insulating films; Charge-discharge studies of charge-carrier trapping in insulating films; Charge injection by electron beam; Scanning electron microscope studies; Study of lateral nonuniformities in metal-insulator-semiconductor structures; Monte-Carlo calculations of hot-electron distributions; and Theoretical modeling of local breakdown. GRA

N74-35270* Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div
REMOTE CONTROL CIRCUIT BREAKER EVALUATION TESTING
Lew M. Bemko *In* NASA. Lyndon B. Johnson Space Center In-Line Task 57 Mar. 1974 86 p refs Revised (For availability see N74-35269 24-31)
(Contract NAS9-12200)
(LEC-0921-Rev-A) CSCL 09A

N74-35271* Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
EVALUATION REPORT FOR TOGGLE SWITCHES: MICRO SWITCH AND CUTLER-HAMMER MODELS PER MIL-S-3950
Don Labberton *In* NASA. Lyndon B. Johnson Space Center In-Line Task 57 Mar. 1974 23 p (For availability see N74-35269 24-31)
(Contract NAS9-12200)
(LEC-1124) CSCL 09A

N74-35272* Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
EVALUATION REPORT FOR TOGGLE SWITCHES: TEXAS INSTRUMENTS, INC., APOLLO-TYPE, AND DAVEN MEASUREMENTS PART NUMBER 45000-XXX, JOB ORDER 32-139
Don Labberton *In* NASA. Lyndon B. Johnson Space Center In-Line Task 57 Mar. 1974 27 p (For availability see N74-35269 24-31)
(Contract NAS9-12200)
(LEC-1667) CSCL 09A

N74-35273* Singer Co., Little Falls, N.J. Kearfott Div.
SOLID STATE SWITCH PANEL Final Report
E. Beenfeldt *In* NASA. Lyndon B. Johnson Space Center In-Line Task 57 Mar. 1974 116 p (For availability see N74-35269

24-31)
(Contract NAS9-13144)
(Y256A226) CSCL 09A

N74-35274* Teledyne Relays, Santa Monica, Calif.
SOLID STATE POWER CONTROLLERS Final Report
R. Stuart Gibbs *In* NASA. Lyndon B. Johnson Space Center In-Line Task 57 Mar. 1974 85 p (For availability see N74-35269 24-31)
(Contract NAS9-12914)
CSCL 09A

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

N74-34668 Missouri Univ., Columbia.
ADAPTIVE CONTROL TECHNIQUES WITHOUT PURTURBATION FOR SYSTEMS WITH INACCESSIBLE STATE VARIABLES WITH APPLICATION TO A SUPERSONIC AIRCRAFT AIR INLET CONTROL SYSTEM Ph.D. Thesis
Larry Eugene Williams 1973 277 p
Avail: Univ. Microfilms Order No. 74-18669

Adaptive control techniques, including both input signal and closed loop system adaptation, are presented. Adaptation procedures and associated identification techniques which utilize the normal operating system input and output signals without extraneous system perturbations are emphasized. Also, it is assumed that the system state variables are inaccessible. Most of the control system adaptation and identification techniques appearing in the literature assume that the system state variables are available for measurement or require extraneous system perturbation signals. The application chosen for investigation of the adaptive control techniques is a hypothetical engine air inlet control system for a supersonic aircraft. Dissert. Abstr.

N74-34669# National Aerospace Lab., Tokyo (Japan). Instrument and Control Div.
OPTIMAL PROBLEM FOR DELAY-DIFFERENTIAL CONTROL SYSTEMS (ON THE EXISTENCE AND UNIQUENESS OF OPTIMAL SOLUTION)
Shigeki Hatayama Feb. 1974 12 p refs
(NAL-TR-357T) Avail: NTIS HC $4.00

General delay-differential control systems dependent on both the previous history of the state and the modelled control. The optimal control problem for such systems with a cost functional, the state constraint condition and the time varying target set is formulated. An existence theorem of an optimal policy in the class of absolutely continuous initial state functions in the C space and measurable control functions in the L sub 2 space are proven. Further, the uniqueness of an optimal control in the case of linear delay-differential systems is considered. Author

N74-34670# University of South Florida, Tampa. Dept. of Electrical Engineering.
SUPER-SCEPTRE. USER'S MANUAL. A PROGRAM FOR THE ANALYSIS OF ELECTRICAL, MECHANICAL, LOGIC AND CONTROL SYSTEMS
J. C. Bowers, J. E. OReilly, Jr., and G. A. Shaw 31 Jan. 1974 200 p refs
(Contract DAAA21-73-C-0433)
(AD-782251) Avail: NTIS CSCL 09/5

SUPERSCEPTRE is a preprocessor developed for use in conjunction with the SCEPTRE circuit analysis program. SUPERSCEPTRE enables the user to simulate one-dimensional mechanical systems, transfer functions, and digital logic devices in addition to electrical networks. SUPERSCEPTRE retains the useful features of SCEPTRE and includes a mechanical description language analogous to the SCEPTRE circuit description language. The language is easy to learn and no previous computer programming experience is needed to use SUPERSCEPTRE effectively. The derivation of equations is not required since SUPERSCEPTRE automatically formulates the describing equations of a system from the component values and the system topology. GRA

N74-34671# Texas Instruments, Inc., Dallas.
BIPOLAR MEDIUM-SCALE INTEGRATED CIRCUIT HARDENING, VOLUME 1, PHASE 1 Final Report, 1 Jan. - 30 Sep. 1973
R. A. Stehlin, Dale DeVries, Ken Bean, Joe Hoffman, and Carl Robbins Apr. 1974 160 p
(Contract F29601-73-C-0048; DNA Proj. NWED-TD-043)
(AD-783360; TI-03-73-88-Vol-1; AFWL-TR-73-293-Vol-1)
Avail: NTIS CSCL 09/5

The results of the shallow device fabrication indicate that low-power Schottky circuitry can be fabricated with full fan-out up to 10 to the 15th power neutron/sq cm. Three profiles have been identified that use an arsenic emitter and a shallow base junction. Ion implantation is used to a high degree. A multilevel metal system with compatible SiCr thin-film resistors has been demonstrated. The improved dielectric effort did not result in a feasible process for this program, but it did demonstrate several fabrication processes that can lead to an improved dielectric process. Author (GRA)

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N74-34672* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
OPEN TUBE GUIDEWAY FOR HIGH SPEED AIR CUSHIONED VEHICLES Patent
Rodney S. Goering, inventor (to NASA) Issued 24 Sep. 1974 4 p Filed 26 Jan. 1972 Supersedes N72-20253 (10 - 11, p 1452)
(NASA-Case-LAR-10256-1; US-Patent-3,837,285; US-Patent-Appl-SN-220785; US-Patent-Class-104-23FS; US-Patent-Class-238-134; US-Patent-Class-104-138R) Avail: US Patent Office CSCL 13F

This invention is a tubular shaped guideway for high-speed air-cushioned supported vehicles. The tubular guideway is split and separated such that the sides of the guideway are open. The upper portion of the tubular guideway is supported above the lower portion by truss-like structural members. The lower portion of the tubular guideway may be supported by the terrain over which the vehicle travels, on pedestals or some similar structure. Official Gazette of the U.S. Patent Office

N74-34673*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
KSC MAINTENANCE CAPABILITY (LABORATORIES AND SHOPS)
5 Sep. 1974 105 p
(NASA-TM-X-70380; KSC-GP-1037) Avail: NTIS HC $8.25 CSCL 14B

A summary of laboratory and shop facilities at Kennedy Space Center that are available to provide a baseline to the offline maintenance requirements for the space shuttle program is provided. Author

N74-34674# Committee on Science and Astronautics (U. S. House).
RESEARCH ON GROUND PROPULSION SYSTEMS
Washington GPO 1974 603 p refs Hearings on H.R. 10392 before Subcomm. on Space Sci. and Applications of Comm. on Sci. and Astronaut., 93d Congr., 2d Sess., No. 38, 11, 12, 13 and 18 Jun. 1974
(GPO-36-993) Avail: Subcomm. on Space Sci. and Appl.

A bill to amend the National Aeronautics and Space Act of 1958 to authorize and direct NASA to conduct research and develop ground propulsion systems which would serve to reduce the current level of energy comsumption was considered in a Congressional hearing. The capital expenditures and health costs of air pollution are evaluated, and details of emission research

findings for alternative motor vehicle power systems are provided, including full breakdowns for research direct expenditures. Industry conversion for production, service, and support of alternative low emission automotive power systems is also considered. A.A.D.

N74-34675*# Electro-Optical Systems, Inc., Pomona, Calif. Electro-Optical Systems Div.
SOLAR SIMULATOR MIRROR REFURBISHMENT Final Report, 27 Jun. 1972 - 30 Sep. 1974
W. R. Leverton 18 Sep. 1974 43 p refs
(Contract NAS9-12960)
(NASA-CR-140298; XEOS-2304) Avail: NTIS HC $5.25 CSCL 14B

Solar simulator mirrors were refurbished. Two different refurbishment methods were employed. In the first, the electroformed mirror replica was removed from the casting and replaced with a new mirror replica. In the second, only the aluminized surface, with its protective overcoat, was removed from the mirror and replaced after cleaning of the nickel surface. Author

N74-34676*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DESIGN FEATURES AND OPERATIONAL CHARACTERISTICS OF THE LANGLEY PILOT TRANSONIC CRYOGENIC TUNNEL
Robert A. Kilgore 23 Sep. 1974 61 p refs
(NASA-TM-X-72012) Avail: NTIS HC $3.75 CSCL 14B

A fan-driven transonic cryogenic tunnel was designed, and its purging, cooldown, and warmup times were determined satisfactory. Cooling with liquid nitrogen is at the power levels required for transonic testing. Good temperature distributions are obtained by using a simple nitrogen injection system. Author

N74-34677*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CALIBRATION OF THE LANGLEY 16-FOOT TRANSONIC TUNNEL WITH TEST SECTION AIR REMOVAL
Blake W. Corson, Jr., Jack F. Runckel, and William B. Igoe Washington Aug. 1974 118 p refs
(NASA-TR-R-423; L-9326) Avail: NTIS HC $4.50 CSCL 14B

The Langley 16-foot transonic tunnel with test section air removal (plenum suction) was calibrated to a Mach number of 1.3. The results of the calibration, including the effects of slot shape modifications, test section wall divergence, and water vapor condensation, are presented. A complete description of the wind tunnel and its auxiliary equipment is included. Author

N74-34678# Joint Publications Research Service, Arlington, Va.
DESIGN AND USE OF UNDERWATER FACILITIES
N. I. Ivanova and A. A. Ishkov 26 Sep. 1974 38 p Transl. into ENGLISH from Ekspress-Inform. (Moscow), ser. 9, no. 4, 1973 p 1-40
(JPRS-63065) Avail: NTIS HC $5.00

Papers, delivered at a 1971 conference in Leningrad on technical methods and equipment in underwater research as a perspective means for developing the ocean are given. Author

N74-34679# National Research Council of Canada, Ottawa (Ontario). Control Systems Lab.
COMMENTS ON A GYRO-STABILISED MONORAIL PROPOSAL
P. A. Hamill, W. F. Hayes, and T. R. Ringer Dec. 1972 56 p refs
(LTR-CS-77) Avail: NTIS HC $6.00

The general feasibility, as well as the control aspects of a specific proposal for a gyro-stabilized high-speed train, running on a single monorail below the vehicle cent of gravity, and comprised of a standard passenger car mounted on pairs of angled wheels running on the single rail is discussed. The expected application is to inter-city passenger transportation, e.g., Montreal-Ottawa-Toronto corridor, at speeds in the order of 150 mph. Pneumatic tire suspension is considered, along with the various safety and economic aspects of system implementation. A comparison of the proposed monorail system with the high speed steel-wheel railway and the tracked air cushion vehicle. Author

N74-34680# Advisory Group for Aerospace Research and Development, Paris (France).
THE NEED FOR A LARGE TRANSONIC WINDTUNNEL IN EUROPE. SECOND REPORT OF THE LARGE WINDTUNNELS WORKING GROUP
Aug. 1974 46 p refs
(AGARD-AR-70) Avail: NTIS HC $5.50

The Second Report of the Large Windtunnels Working Group of the AGARD Fluid Dynamics Panel is presented. The group confined its further considerations to the need for and definitions of a large transonic windtunnel in Europe. The engineering studies on the proposed four options for the tunnel drive system are reviewed; engineering of all four appears to be feasible but at higher cost than anticipated. The Group still cannot recommend a preferred option technical grounds, but recommends that following further work a selection should be made before the end of 1975. The program of further work necessary to provide the information needed for selection of a preferred option is defined, together with recommendations on how it should be shared between National Programs and on indepedent Technical Project Group, with coordination as required by the MiniLaWs Group of the Fluid Dynamics Panel. It is concluded that the reasons given on the need for a large European transonic windtunnel still apply, and no change is required in the standard specification of the windtunnel. Author

N74-34681# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE STARS FALL UPWARD
V. Gubarev 18 Jun. 1974 44 p Transl. into ENGLISH from the book "Povoliteli Strategicheskikh" USSR, 1972 p 83-98
(AD-783048; FTD-MT-24-1428-74) Avail: NTIS CSCL 16/1

The brief translation describes the people, the buildings, the launching pads, the life and the work at a Soviet missile range. GRA

N74-34682# Avco Corp., Wilmington, Mass.
PARAMFTRIC STUDY FOR A CONCEPTUAL MULTICOMPONENT FLOW SYSTEM Final Report, 1 Feb. - 1 Oct. 1973
George D. Waldman May 1974 84 p refs
(Contract F33615-73-C-4042; AF Proj. 7065)
(AD-783213; ARL-74-0030) Avail: NTIS CSCL 14/2

The parametric design of a high-speed multicomponent-flow test facility is studied. Approximate optimum analyses are derived for the acceleration phase of such a device. Problems in one-dimensional energy transfer between high-speed particles and gas are investigated. A two-dimensional finite-difference computer analysis of the interaction of particles and accelerating gas flows is carried out. Results are presented for both direct and intermediate energy-transfer processes. Parameters affecting system performance are evaluated and optimum configurations are described. Author (GRA)

N74-34683# Illinois Univ., Savoy. Aviation Research Lab.
AIRCRAFT SIMULATOR MOTION AND THE ORDER OF MERIT OF FLIGHT ATTITUDE AND STEERING GUIDANCE DISPLAYS Scientific Interim Report
Fuat Ince, Robert C. Williges, and Stanley N. Roscoe Oct. 1973 12 p refs Presented at the 17th Ann. Meeting of the Human Factors Soc., Washington, D. C., 16-18 Oct. 1973
(Contract N00014-67-A-0305-0014; F44620-70-C-0105; NR Proj. 196-02)
(AD-782588; ARL-73-27/ONR-73-6/AFOSR-73-16) Avail: NTIS CSCL 01/3

Twenty-four nonpilot, volunteer subjects were tested on three flight tasks while flying four basic aircraft attitude presentations (moving horizon, moving airplane, frequency-separated, and kinalog) in a light twin-engine aircraft simulator providing three levels of motion cues (no motion, standard GAT-2 motion, and washout motion). The flight tasks involved conflicting visual and vestibular cues and included disturbed attitude tracking, command flight path tracking in both pursuit and compensatory modes, and a series of recovery trials from discrete unknown attitudes. To provide a basis for comparison, the present simulator study closely replicated the procedures used in the Roscoe and Williges (1973) flight experiment. The frequency-separated display provided performances at least equivalent and in some cases superior to those obtained with the conventional moving horizon

display. Either type of simulator motion resulted in better disturbed attitude tracking performance than no motion, and washout motion provided stereotype control responses in recovery from unknown attitudes most closely corresponding to those obtained in flight. It was concluded that care must be used in generalizing simulator results to flight performance when no physical motion cues or inappropriate ones are present in the simulator. Author (GRA)

N74-34684# Scripps Institution of Oceanography, La Jolla, Calif. Advanced Ocean Engineering Lab.
ADVANCED MARINE TECHNOLOGY: STABLE FLOATING PLATFORM PROJECT Final Report, 15 Dec. 1968 - 31 Dec. 1973
F. N. Spiess May 1974 97 p refs
(Contract N00014-69-A-0200-6012; NR Proj. 294-016)
(AD-783097; AOEL-60; SIO-Ref-74-17) Avail: NTIS CSCL 01/5

The study developed designs and demonstrated techniques for coupling large platform sections together at sea. Most recent investigations of feasibility of construction at sea of a large airfield, e.g. 6000 feet long, have employed a barge to haul stable column legs, cross members and associated coupling equipment to a construction site, flip with load from horizontal to vertical, then separate and, finally assemble with the barge in vertical mode serving as a work vehicle part of the platform. Two major conclusions are drawn from the investigations: First that assembly in the open ocean of large floating platforms employing stable columns or spar buoys is feasible; Second, the flippable barge employed in most recent large platform construction has considerable potential as an ocean engineering support vehicle. (Modified author abstract) GRA

N74-34685# Pereira (William L.) Associates, Corona del Mar, Calif.
DULLES URBAN CENTER CONCEPTS
Ronald D. Allum, Gregory D. Billingham, Frank Dimster, Chuck Grein, and Larry J. Hurlbut 1 Aug. 1973 132 p refs
(Contract DOT-FA72WA-2279)
(AD-777991) Avail: NTIS CSCL 13/2

The report presents a multidisciplinary study to determine the feasibility of developing a unique urban center to be located in the vicinity of the Dulles International Airport property, utilizing transportation, urbanization and aviation concepts developed in the planning concepts study. The investigation includes alternative programs, locations and land uses, vehicular circulation and parking concepts, pedestrian circulation, economic objectives and analyses, building types, massing, volume, site studies, methods of financing, operation, ownership and the role of government agencies, as well as the private sector. GRA

N74-34686# Teledyne Ryan Aeronautical Co., San Diego, Calif.
CATAPULT PERFORMANCE AND INTERFACE REQUIREMENTS FOR LAUNCH OF BQM-34 VEHICLES Final Report
10 Jun. 1974 103 p refs
(Contract F04606-73-A-0048)
(AD-783935; TRA-29369-5) Avail: NTIS CSCL 01/5

The report provides information for the design of a catapult launcher for the Teledyne Ryan BQM-34A and BQM-34F series of drones. Information provides performance and vehicle interface data for an independent contractor to prepare cost estimates for the design and manufacture of a catapult launcher. Curves of engine data are provided for various temperature and pressure conditions. Aerodynamic loads for various pitch attitudes up to 250 KEAS are included. Limit load factor envelopes and limit loads for the present ground launch fittings are presented. Conclusions based on the results of a six-degree-of-freedom dynamic simulation study for a catapult launch of a BQM-34A with the LSI A/A37G-8 autopilot are given. GRA

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N74-34687 Polish Academy of Sciences, Warsaw.
SOME ASPECTS OF NONLINEAR STABILITY THEORY
K. Stewartson 1973 45 p refs Presented at 11th Symp. on Advanced Probl. and Methods in Fluid Mech., Kamienny Potok, Poland, 3-8 Sep. 1973
(Rept-32/1973) Avail: Issuing Activity

Several theoretical approaches to understanding nonlinear stability theory and their application to boundary layer flow are examined. Transition and laminar flow breakdown were emphasized. E.H.W.

N74-34688 Pennsylvania State Univ., University Park.
A SOLUTION FOR BOUNDARY PROBLEMS IN ISENTROPIC COORDINATE MODELS Ph.D. Thesis
Dennis George Deaven 1974 147 p
Avail: Univ. Microfilms Order No. 74-20994

A two-dimensional, hydrostatic, primitive equation, numerical model was designed to evaluate a new vertical coordinate scheme for global circulation or numerical prediction models. Because potential temperature is nearly conserved for large scale atmospheric flow, potential temperature was utilized as the vertical coordinate in the layer bounded by the lower troposphere and the top of the model atmosphere which is near the middle stratosphere. The vertical coordinate scheme utilized a variable depth boundary layer in which a generalized function of pressure was the vertical coordinate. No coordinate surface intersects the surface of the earth. Adiabatic and superadiabatic lapse rates can develop near the surface of the earth because the vertical coordinate in this region is a quasihorizontal function of pressure. The prognostic equations were solved by a finite differencing technique that is centered in space and time. Dissert. Abstr.

N74-34689 Tulane Univ., New Orleans, La.
AN INVESTIGATION OF THE INTENSITY OF TURBULENCE IN A GASEOUS ROCKET COMBUSTION CHAMBER Ph.D. Thesis
Patrick Pu-Jen Tou 1974 103 p
Avail: Univ. Microfilms Order No. 74-20774

The intensity of turbulence and the Lagrangian correlation coefficient for a gaseous rocket combustion chamber were determined from the experimental measurements of the tracer gas diffusion. A combination of Taylor's turbulent diffusion theory and Spalding's numerical procedure for solving the conservation equations of fluid mechanics was used to calculate these quantities. Taylor's theory was extended to consider the inhomogeneity of the turbulence field in the axial direction of the combustion chamber. The results indicate that the maximum value of the intensity of turbulence is about 15.5% and the Lagrangian correlation coefficient drops to about 0.12 in one inch of the chamber length. Dissert. Abstr.

N74-34690 New York Univ., N.Y. School of Engineering and Science.
THE ANALYSIS OF VISCOUS-INVISCID INTERACTIONS IN EXPANDING AND COMPRESSING FLOWFIELDS Ph.D. Thesis
Andrew J. Srokowski 1974 80 p
Avail: Univ. Microfilms Order No. 74-21551

An analysis of the laminar viscous inviscid interaction problem is presented which takes into account incoming and outgoing waves and the normal pressure gradient in the boundary layer. The analysis is tested for general applicability. Problems involving both expansion and compression are treated. The first problem considers both two-dimensional and axisymmetric blunt bodies in hypersonic flight. The effects of the viscous-inviscid interaction on surface flow properties is assessed and compared to experimental data for the axisymmetric body. The second problem studied is the compression corner interaction leading to flow separation. Several test cases are run and the results compared with experiment. Dissert. Abstr.

N74-34691 Connecticut Univ., Storrs.
TURBULENT BOUNDARY LAYER SEPARATION OF AXISYMMETRIC AFTERBODIES Ph.D. Thesis
Walter Michael Presz, Jr. 1974 197 p
Avail: Univ. Microfilms Order No. 74-21816

A number of models were tested at subsonic Mach numbers.

The data obtained systematically show the effect of shape, Mach number, total pressure and approach boundary layer thickness on the onset and extent of flow separation over afterbody models. The separation and reattachment locations on the afterbody were determined by oil flow visualization techniques. Existing separation criteria are compared to the data. The separation data are used to support an engineering model of the separated flow field. A predictive technique is then developed based upon an iteration scheme between four components: an inviscid flow field calculation, an attached boundary layer calculation, a separation point prediction, and a reverse flow model. This engineering analysis is shown to accurately predict the effects of turbulent boundary layer separation on afterbody pressure distributions and pressure drag. Dissert. Abstr.

N74-34692 California Univ., San Diego.
ENERGY TRANSFER IN HIGH REYNOLDS NUMBER TURBULENCE Ph.D. Thesis
Kenneth Norman Helland 1974 206 p
Avail: Univ. Microfilms Order No. 74-22201

The net spectral energy transfer of turbulent velocity fields over a wide range of Reynolds numbers were examined by experimental empirical methods. Measurements in a high Reynolds number grid flow were used to calculate the energy transfer by the Fourier transform method of Yeh and Van Atta. Measurements in a free jet were used as a model for a still higher Reynolds number hypothetical grid flow. An empirical energy spectrum is proposed in conjunction with a locally self-preserving approximation to estimate energy transfer at very high Reynolds numbers. A local self-preservation assumption was made to permit a more complete analysis of the grid and jet experiments. The energy decay spectrum is approximated by assuming the energy spectrum is self-preserving over short times, and the results are compared with previous measurements of decay and transfer spectra in grid turbulence. Dissert. Abstr.

N74-34693 Houston Univ., Tex.
A FOUR-EQUATION MODEL FOR NUMERICAL SOLUTION OF THE TURBULENT BOUNDARY LAYER Ph.D. Thesis
HyppolitodoValle PereiraFilho 1974 247 p
Avail: Univ. Microfilms Order No. 74-21392

A four-equation model of turbulence is presented in order to solve the steady, incompressible two-dimensional turbulent boundary layer flow field. Those four equations are the continuity, momentum, turbulent kinetic energy, and the rate of dissipation equations. The solution is obtained in terms of the mean variables of the flow field. Closure is obtained by assuming for each equation that all those terms containing fluctuating quantities are somehow related to the mean variables of the mean flow field. A two-layer eddy viscosity model is used. Near the wall, the eddy viscosity is assumed to be proportional to the second power of the vertical coordinate. For the outer layer, it is assumed that it is proportional to the ratio of the square of the turbulent kinetic energy to the rate of dissipation. Dissert. Abstr.

N74-34694 Connecticut Univ., Storrs.
ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF A FREE-VORTEX SUPERSONIC NOZZLE FOR AERODYNAMIC WINDOWS Ph.D. Thesis
Roy Nathan Guile 1974 179 p
Avail: Univ. Microfilms Order No. 74-21780

A supersonic jet which consists of a segment of a free-vortex flow field was used to seal a low pressure region from the higher pressure surroundings. The low pressure region simulated a laser cavity at a pressure of 50 torr. The supersonic jet represented an aerodynamic window which would isolate a laser cavity from its surroundings and would permit the laser beam to exit from the cavity. The operating principle of the aerodynamic window is described and a procedure for determining the aerodynamic properties of the segment of the free vortex to be used in designing aerodynamic windows is presented. Data, including pitot and static pressure measurements and schlieren photographs, are presented which affirm the validity of the analytical design procedure for the free-vortex supply nozzle. The effectiveness of the free-vortex segment in sealing the low pressure simulated laser cavity is confirmed by the experimental data. Dissert. Abstr.

N74-34695 Illinois Univ., Chicago.
A STATISTICAL DESCRIPTION OF TURBULENT SHEAR FLOWS CHARACTERIZED BY A FINITE NUMBER OF NONEQUILIBRIUM DEGREES OF FREEDOM Ph.D. Thesis
Ronald John Bywater 1974 189 p
Avail: Univ. Microfilms Order No. 74-20870

A statistical description of turbulent flow fields characterized by multiple significant length scales was formulated. The formulation represents an extension of a simplified statistical theory of turbulence. In order to derive the above mentioned equation, the turbulence dynamics are represented by generalized Brownian Stochastics in terms of two coupled Langevin equations of two nonequilibrium degrees of freedom. Various characteristics of the governing equation are discussed along with limiting solutions and the solution of a simple shear flow with two dynamically significant length scales used to elucidate the wall region of a rough wall boundary layer. Dissert. Abstr.

N74-34696*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ON CONDITIONAL SAMPLING FOR TURBULENT FLOW STUDIES
F. C. Wang (NAS-NRC) 16 Sep. 1974 20 p refs
(NASA-TM-X-64886) Avail: NTIS HC $3.00 CSCL 20D

The conditional sampling technique is analyzed as a weighted time average for turbulent flow. The various conditional averages are obtained by using different types of weighting functions. A second averaging relation is obtained between the conventional averages and the conditional averages. A few examples are given in which simplified expressions are used. Author

N74-34697*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
MEASUREMENT AND CORRELATION OF AERODYNAMIC HEATING TO SURFACE CORRUGATION STIFFENED STRUCTURES IN THICK TURBULENT BOUNDARY LAYERS Final Technical Report
H. J. Brandon and R. V. Masek 8 Oct. 1974 81 p refs
(Contract NAS1-12901)
(NASA-CR-132503) Avail: NTIS HC $4.00 CSCL 20D

The flow conditions for which heating distributions were measured on corrugated surfaces and wavy walls in turbulent boundary layers are shown, along with the ratio of the displacement thickness to the roughness height versus the local edge Mach number for an equivalent smooth surface. The present data are seen to greatly extend the range of data available on corrugated surfaces in turbulent boundary layers. These data were obtained by testing fullscale corrugation roughened panels in the wall boundary layer of a supersonic and hypersonic wind tunnel. The experimental program used to obtain the data is described. The data are analyzed and correlated in terms of the pertinent flow and geometric parameters. The developed correlations are compared with the available thin boundary layer data, as well as with previously published correlation techniques. Author

N74-34698*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPRESSIBLE SEAL FLOW ANALYSIS USING THE FINITE ELEMENT METHOD WITH GALERKIN SOLUTION TECHNIQUE
John Zuk 1974 54 p refs Presented at Lubrication Conf., Montreal, 8-10 Oct. 1974; sponsored by ASME and Am. Soc. of Lubrication Engr.
(NASA-TM-X-71604; E-5116-2) Avail: NTIS HC $3.75 CSCL 20D

High pressure gas sealing involves not only balancing the viscous force with the pressure gradient force but also accounting for fluid inertia--especially for choked flow. The conventional finite element method which uses a Rayleigh-Ritz solution technique is not convenient for nonlinear problems. For these problems, a finite element method with a Galerkin solution technique (FEMGST) was formulated. One example, a three-dimensional axisymmetric flow formulation has nonlinearities due to compressibility, area expansion, and convective inertia. Solutions agree with classical results in the limiting cases. The development of the choked flow velocity profile is shown. Author

N74-34699*# Iowa State Univ. of Science and Technology, Ames. Engineering Research Inst.
IMPROVED CURVE FITS FOR THE THERMODYNAMIC PROPERTIES OF EQUILIBRIUM AIR SUITABLE FOR NUMERICAL COMPUTATION USING TIME-DEPENDENT OR SHOCK-CAPTURING METHODS, PART 1 Final Report
J. C. Tannehill and P. H. Mugge Washington NASA Oct. 1974 38 p refs
(Grant NGR-16-002-038)
(NASA-CR-2470) Avail: NTIS HC $3.25 CSCL 20D

Simplified curve fits for the thermodynamic properties of equilibrium air were devised for use in either the time-dependent or shock-capturing computational methods. For the time-dependent method, curve fits were developed for p = p(e, rho), a = a(e, rho), and T = T(e, rho). For the shock-capturing method, curve fits were developed for h = h(p, rho) and T = T(p, rho). The ranges of validity for these curves fits were for temperatures up to 25,000 K and densities from 10 to the minus 7th power to 10 to the 3d power amagats. These approximate curve fits are considered particularly useful when employed on advanced computers such as the Burroughs ILLIAC 4 or the CDC STAR.
Author

N74-34700*# Scientific and Business Consultants, Inc., Atlanta, Ga.
ANALYSIS OF DYNAMIC STALL USING UNSTEADY BOUNDARY-LAYER THEORY Final Report
R. M. Scruggs, J. F. Nash, and R. E. Singleton Oct. 1974 66 p refs
(Contract NAS1-11991)
(NASA-CR-2462) Avail: NTIS HC $3.75 CSCL 01A

The unsteady turbulent boundary layer and potential flow about a pitching airfoil are analyzed using numerical methods to determine the effect of pitch rate on the delay in forward movement of the rear flow reversal point. An explicit finite difference scheme is used to integrate the unsteady boundary layer equations, which are coupled at each instant of time to a fully unsteady and nonlinear potential flow analysis. A substantial delay in forward movement of the reversal point is demonstrated with increasing pitch rate, and it is shown that the delay results partly from the alleviation of the gradients in the potential flow, and partly from the effects of unsteadiness in the boundary layer itself. The predicted delay in flow-reversal onset, and its variation with pitch rate, are shown to be in reasonable agreement with experimental data relating to the delay in dynamic stall. From the comparisons it can be concluded (a) that the effects of time-dependence are sufficient to explain the failure of the boundary layer to separate during the dynamic overshoot, and (b) that there may be some link between forward movement of the reversal point and dynamic stall.
Author

N74-34701*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TABLES AND CHARTS OF EQUILIBRIUM NORMAL SHOCK AND SHOCK-TUBE SOLUTIONS FOR HELIUM-HYDROGEN MIXTURES WITH VELOCITIES TO 70 km/seC
Charles G. Miller, III and Sue E. Wilder 1974 812 p refs
(NASA-SP-3085) Avail: NTIS HC $17.50 CSCL 20D

Equilibrium thermodynamic and flow properties are presented in tabulated and graphical form for moving, standing, and reflected normal shock waves into helium-hydrogen mixtures representative of proposed outer planet atmospheres. The volumetric compositions of these mixtures are 0.35He-0.65H2, 0.20He-0.80H2, and 0.05He-0.95H2. Properties include pressure, temperature, density, enthalpy, speed of sound, entropy, molecular-weight ratio, isentropic exponent, velocity, and species mole fractions. Incident (moving) shock velocities are varied from 4 to 70 km/sec for a range of initial pressure of 5 N/sq m to 100 kN/sq m. The present results are applicable to shock-tube flows and to free-flight conditions for a blunt body at high velocities. A working chart illustrating idealized shock-tube performance with a 0.20He-0.80H2 test gas and heated helium driver gas is also presented.
Author

N74-34702*# Purdue Univ., Lafayette, Ind. Thermal Science and Propulsion Center.
APPLICATION OF THE SCALAR AND VECTOR POTENTIALS TO THE AERODYNAMICS OF JETS
H. L. Russell and J. G. Skifstad Aug. 1973 142 p refs
(Grant NGL-15-005-094)
(NASA-CR-132528; PRF-5551) Avail: NTIS HC $10.25 CSCL 20D

The applicability of a method based on the Stokes potentials (vector and scalar potentials) to computations associated with the aerodynamics of jets was examined. The aerodynamic field near the nozzle could be represented and that the influence of a nonuniform velocity profile at the nozzle exit plane could be determined. Also computations were made for an axisymmetric jet exhausting into a quiescient atmosphere. The velocity at the axis of the jet, and the location of the half-velocity points along the jet yield accurate aerodynamic field computations. Inconsistencies among the different theoretical characterizations of jet flowfields are shown.
Author

N74-34703*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
USE OF HEXAFLUOROETHANE TO SIMULATE THE INVISCID REAL-GAS EFFECTS ON BLUNT ENTRY VEHICLES
James L. Hunt, Robert A. Jones, and Kathryn A. Smith Washington Oct. 1974 46 p refs
(NASA-TN-D-7701; L-9459) Avail: NTIS HC $3.25 CSCL 20D

Results are presented of an experimental and theoretical investigation of the use of equilibrium hexafluoroethane C2F6 as an undissociated test gas in a wind tunnel to simulate the inviscid aerodynamic characteristics of blunt bodies in high-speed flight where dissociation occurs. The results indicate that the use of C2F6 as a test gas in wind tunnels is a practical and relatively simple and inexpensive method of obtaining test conditions with large normal-shock density ratios. Equations for the thermodynamic and transport properties of C2F6 are also included.
Author

N74-34704*# National Bureau of Standards, Boulder, Colo.
CAVITATION IN LIQUID CRYOGENS. 4: COMBINED CORRELATIONS FOR VENTURI, HYDROFOIL, OGIVES, AND PUMPS Final Report
J. Hord Washington NASA Oct. 1974 104 p refs
(NASA Order C-39004B)
(NASA-CR-2448) Avail: NTIS HC $4.50 CSCL 20D

The results of a series of experimental and analytical cavitation studies are presented. Cross-correlation is performed of the developed cavity data for a venturi, a hydrofoil and three scaled ogives. The new correlating parameter, MTWO, improves data correlation for these stationary bodies and for pumping equipment. Existing techniques for predicting the cavitating performance of pumping machinery were extended to include variations in flow coefficient, cavitation parameter, and equipment geometry. The new predictive formulations hold promise as a design tool and universal method for correlating pumping machinery performance. Application of these predictive formulas requires prescribed cavitation test data or an independent method of estimating the cavitation parameter for each pump. The latter would permit prediction of performance without testing; potential methods for evaluating the cavitation parameter prior to testing are suggested.
Author

N74-34705# California Univ., Berkeley. Dept. of Mechanical Engineering.
RECENT CONTRIBUTIONS TO THE METHOD OF CHARACTERISTICS FOR THREE-DIMENSIONAL PROBLEMS IN GAS DYNAMICS
Maurice Holt Apr. 1974 28 p refs
(Contract N00014-69-A-0200-1020)
(AD-782280; FM-74-2) Avail: NTIS CSCL 20/4

The numerical method of characteristics for problems in three or more independent variables are reviewed. Particular emphasis is laid on recent methods developed in Germany; notably the optimal characteristic method of Bruhn - Haack and Schaetz, and the near characteristics method of Sauer. In all these methods, difference equations are established in their most compact form and, at each point, all outer directional derivatives are in one plane. in Sauer's method, this plane is always parallel to a fixed plane. The methods are all derived rigorously and satisfy conditions of equivalence, uniqueness, and convergence. The

optimal characteristics method has been applied very successfully to the problem of unsteady flow through a Laval nozzle. (Modified author abstract) GRA

N74-34706# ARO, Inc., Arnold Air Force Station, Tenn.
ARGON CONDENSATION IN FREE-JET EXPANSIONS Final Report, 1 Nov. 1972 - 31 Jul. 1973
J. W. L. Lewis and W. D. Williams AEDC Jul. 1974 40 p refs Sponsored by the AF
(AD-782445; AEDC-TR-74-32; ARO-VKF-TR-74-13) Avail: NTIS CSCL 20/4

Homogeneous condensation of argon was observed using sonic orifice expansion flow fields. The room temperature argon was studied over the range of reservoir pressures from 200 to 750 torr using a 3.2-mm orifice diameter. Condensation onset and the subsequent cluster growth was observed using laser Rayleigh scattering, and maximum supersaturation ratios as a function of reservoir pressures were determined. Depolarization ratio measurements were performed for the 750-torr expansion, and shape changes of the cluster were observed throughout the growth region. Comparisons of these results and previous mass spectrometric data are made, and specifically the mass fraction of argon condensate and cluster sizes are estimated.
Author (GRA)

N74-34707# Ohio State Univ., Columbus. Dept. of Aeronautical and Astronautical Engineering.
COMPARATIVE STUDY OF TURBULENCE MODEL FOR BOUNDARY LAYERS AND WAKES Final Report, 1 Oct. 1970 - 30 Nov. 1973
Odus R. Burggraf May 1974 90 p refs
(Contract F33615-71-C-1097; AF Proj. 7064)
(AD-783193; ARL-74-0031) Avail: NTIS CSCL 20/4

In recent times a great number of computer models of turbulence has been applied to a variety of turbulent flow problems, with greatest emphasis on boundary layers. The purpose of this report is to investigate several of these models that typify the various classes of models with the view of applying them to more general flow situations. The mathematical form of the solution near discontinuities in boundary conditions is worked out for several models, following Goldstein's analysis for laminar flows. Numerical solutions for compressible and incompressible flows are presented for the boundary layer on a flat plate and for the incompressible wake of a flat plate, and compared with experimental data. The report concludes by modifying the models of Glushko and of Cebeci and Smith to allow computation of free shear layers. (Modified author abstract) GRA

N74-34708# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MASS TRANSFER IN A LIMITED SPACE
A. A. Shatil and V. N. Danilovtsev 17 Jun. 1974 16 p refs Transl. into ENGLISH from Teoriya i Prakt. Szhiganiya Gaza, Tr. Nauchn.-Tekhn. Soveshch. (Moscow), v. 5, 1972 p 33-41
(AD-782536; FTD-HT-23-867-74) Avail: NTIS CSCL 20/4

The mixing process in combustion chambers and furnaces of boiler assemblies is dependent upon the velocity gradient which determines the turbulent and convective mass transfer. The report examines two cases of a flow with velocity gradient in a limited space. The analysis showing that the flow and mass transfer together, can also be extended to the axisymmetric flow behind a poorly streamlined body or behind a register with blades which eddy the flow. GRA

N74-34709# United Aircraft Corp., East Hartford, Conn.
A MULTI-STREAM COMPRESSIBLE FLOW COMPUTERIZED ANALYSIS Interim Report
L. S. Cohen and R. J. Flaherty May 1974 45 p refs
(Contract F44620-73-C-0031; AF Proj. 9783)
(AD-783297; UARL-N110997-2; AFOSR-74-1282TR) Avail: NTIS CSCL 20/4

A description of a FORTRAN 5 computer code for predicting the inviscid flow field produced by the interaction between several adjacent streams is presented. The flow field solution is based on the method of characteristics. To illustrate the use of the code, analytical results are used to develop optical property predictions for both the near and far fields for centrifugal aerowindow flow fields generated by four, two, and single nozzles. Further, a comparison is made between the four nozzle aerowindow far field optical predictions and experimental results. All instructions needed for execution of the computer program are contained within. Author (GRA)

N74-34710# ARO, Inc., Arnold Air Force Station, Tenn.
SIMULATION OF FLOW APPROACHING THE CHIN INLET OF A RAMJET MISSILE Final Report, 1 Jul. 1972 - 30 Jun. 1973
R. C. Bauer, W. W. Muse, and C. R. Tinsley Jul. 1974 43 p refs Sponsored by AEDC
(AD-783244; AEDC-TR-74-5) Avail: NTIS CSCL 21/5

A new Aerodynamic and Propulsion Test Unit (APTU) is being constructed at AEDC for testing air-breathing missiles that operate at supersonic Mach numbers. One type of missile configuration that may be tested in the APTU is that having a forward-located chin inlet. A technique for simulating the flow approaching a chin inlet is studied within the limitations of test body size, nozzle size, and diffuser performance expected in the APTU. Analytical techniques are presented for positioning the test body to obtain maximum altitude simulation and for estimating the general diffuser performance and starting conditions. A consideration of the flow processes that limit diffuser performance in a conventional test arrangement led to the concept of extending the diffuser over the test body. (Modified author abstract) GRA

N74-34711# Tennessee Univ. Space Inst., Tullahoma.
A FIRST ORDER THEORY FOR TRANSONIC FLOW OVER A CONICAL FLARE
Jain-Ming Wu and Heinz H. Venghaus 10 May 1974 22 p refs
(Contract DAAH01-74-C-0183; DA Proj. 1M2-62303-A-214)
(AD-782974; RD-CR-74-3) Avail: NTIS CSCL 20/4

An approximate theory for the transonic flow over a flared afterbody has been developed for zero and small angles of attack. Comparisons with available experimental data are made. Limitation and assumptions used in the derivation are pointed out. Author (GRA)

N74-34712# Tennessee Univ. Space Inst., Tullahoma.
AN APPROXIMATE TRANSONIC CALCULATIVE METHOD APPLIED TO VARIOUS SMOOTH SHAPED NOSE-CYLINDRICAL BODIES
Heinz H. Venghaus and Jain-Ming Wu 10 May 1974 33 p refs
(Contract DAAH01-74-C-0183; DA Proj. 1M2-62303-A-214)
(AD-782968; RD-CR-74-2) Avail: NTIS CSCL 20/4

An approximate transonic small disturbance technique originally developed for ogival noses and cylindrical afterbodies has been extended to arbitrary smooth nose forebodies and cylindrical afterbodies. Limitations of the method and trends are discussed. Author (GRA)

N74-34713# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LOW-DENSITY JETS BEHIND A SONIC NOZZLE AT LARGE PRESSURE GRADIENTS
V. V. Volchkov, A. V. Ivanov, N. I. Kislyakov, A. K. Rebrov, and V. A. Sukhnev 28 Jun. 1974 21 p refs Transl. into ENGLISH from Zh. Prikl. Mekhan. i Tekhn. Fiz. (Moscow), no. 2, Mar./Apr. 1973 p 64-73
(AD-783456; FTD-MT-24-1330-74) Avail: NTIS CSCL 20/4

The gas dynamic structure of a low density jet of diatomic gas behind a sonic nozzle with large pressure gradients is reported. The experimental data on the change of the jet structure are given depending on the Reynolds Number. On the basis of the results of measurements, it is shown that the flow behind a Mach disk is kept subsonic on the axis at a distance of several lengths of the first cycle. M.C.F.

N74-34714*# Stanford Univ., Calif. Thermosciences Div.
A METHOD FOR CALCULATION OF A FULLY STALLED FLOW Interim Report
R. L. Woolley and S. J. Kline Nov. 1973 221 p refs
(Contract F44620-69-C-0010; Grant NGR-05-020-526)
(NASA-CR-140529; AFOSR-74-1293TR; AD-783303; MD-33) Avail: NTIS HC $14.25 CSCL 20/4

An interacting zone method of calculation is developed for

predicting stalled turbulent flows which are nominally two-dimensional, incompressible, and steady. The total problem is divided into zones selected such that each can be represented by a manageable analytical model. When applied to the case of the fully stalled diffuser, adequate a priori predictions are achieved with careful handling. Predictions show a strong sensitivity to location of separation -- as does the actual diffuser. This suggests specific further consideration of analytical models for the zone near separation. Given improved modeling of conditions in the vicinity of separation, even more accurate predictions of the primary flow characteristics are highly likely. (Modified author abstract) GRA

N74-34715# Hydronautics, Inc., Laurel, Md.
SIMULATION OF WAKE VORTICES DESCENDING IN A STABLY STRATIFIED ATMOSPHERE Final Report, Sep. 1973 - Mar. 1974
Clinton E. Brown and Karl Kirkman Jul. 1974 38 p refs
(Contract DOT-TSC-694)
(AD-783750; FAA-RD-74-116; TSC-FAA-74-13) Avail: NTIS CSCL 01/1

An experimental water tank simulation of aircraft wake vortices descending in a stable atmosphere has indicated that the atmospheric stability stops the downward movement and in some cases produces a subsequent rebound. The tests were carried out in a large ship model basin using a rectangular planform wing. Lift coefficients were selected, and stable atmospheric conditions were obtained by temperature (density) stratification of the towing basin. The model parameters and stability conditions cover the most extreme cases to be expected in full scale flight. GRA

N74-34716# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
ANALYSIS OF PREDICTED AIRCRAFT WAKE VORTEX TRANSPORT AND COMPARISON WITH EXPERIMENT. VOLUME 1: WAKE VORTEX PREDICTIVE SYSTEM STUDY Final Report, Apr. - Dec. 1973
M. R. Brashears, N. A. Logan, S. J. Robertson, K. R. Shrider, and C. D. Walters Apr. 1974 247 p refs
(Contract DOT-TSC-593)
(AD-783649; TSC-FAA-74-7-Vol-1; FAA-RD-74-74-I) Avail: NTIS CSCL 01/1

A unifying wake vortex transport model is developed and applied to a wake vortex predictive system concept. The fundamentals of vortex motion underlying the predictive model are discussed including vortex decay, bursting and instability phenomena. A parametric and sensitivity analysis is presented to establish baseline uncertainties in the algorithm to allow meaningful comparison of predicted and measured vortex tracks. A detailed comparison of predicted vortex tracks with photographic and groundwind vortex data is presented. Excellent agreement between prediction and measurement is shown to exist when sufficient wind data are available. Application of the Pasquill class criteria is shown to be an effective technique to describe the wind profile in the absence of detailed wind data. The effects of wind shear and the Ekman spiral on vortex transport are discussed. It is shown that the combination of wind shear and ground plane may be possible mechanisms underlying vortex tilting and a theoretical explanation is advanced that is somewhat supported by comparison with the experimental data. Finally, recommendations for further vortex data collection in the vicinity of an airport are presented. Author (GRA)

N74-34717# Army Foreign Science and Technology Center, Charlottesville, Va.
BODIES OF REVOLUTION WITH MINIMUM DRAG COEFFICIENT AND LOW HEAT TRANSFER AT HIGH SUPERSONIC FLIGHT VELOCITIES
G. L. Grodzovskii 9 May 1974 17 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (Moscow), no. 5, 1968 p 79-88
(AD-783730; FSTC-HT-23-714-70) Avail: NTIS CSCL 20/4

The optimal shape of a body of revolution with minimum drag at hypersonic velocities is investigated on the basis of modified Newtonian theory and theory of self-modeling hypersonic flow. It is shown that bodies of optimal form also have a low coefficient of heat transfer, considerably lower than that of conical bodies. It is established experimentally that the optimal properties of the bodies of revolution examined are retained at moderate supersonic flight velocities. GRA

N74-34718# Tennessee Univ. Space Inst., Tullahoma.
AN APPROXIMATE SOLUTION OF UNSTEADY TRANSONIC FLOW PROBLEMS Technical Report, Jun. 1973 - Jan. 1974
J. M. Wu and K. R. Kimble Jun. 1974 38 p refs
(Contract F33615-73-C-3119; AF Proj. 1929)
(AD-783621; AFFDL-TR-74-32) Avail: NTIS CSCL 01/1

Unsteady pressures on a thin two-dimensional airfoil pitching and plunging in transonic flow have been computed by numerically solving the governing partial differential equation. The effect of wing thickness has been retained by using the steady flow potential on the wing in the coefficients of the equation in a manner which generalizes Oswatitsch's parabolic method. The results are compared with other methods and with experimental data. Author (GRA)

N74-34719# General Electric Co., Schenectady, N.Y. Research and Development.
TECHNIQUES FOR INJECTION AND ACCELERATION OF PARTICLES BY ULTRA HIGH SPEED GAS JETS Final Report, 5 Jan. - 20 Nov. 1973
Elwin C. Bigelow, Henry T. Nagamatsu, Russell E. Sheer, Jr., and James C. F. Wang Feb. 1974 90 p refs
(Contract F33615-73-C-4051; AF Proj. 7065)
(AD-783911; SRD-73-161; ARL-74-0013) Avail: NTIS CSCL 20/4

An investigation was conducted to accelerate solid and liquid particles in single and two stage nozzles with air and helium as the carrier gas in the primary nozzle. Methods were developed for injection and the particles were accelerated to supersonic air and helium velocities. Schlieren and light scattering systems were used to observe the shock waves in the flows and the liquid and solid particle streams discharging from the turning vanes and the nozzles. Laser Doppler velocimeter technique was utilized to measure the mean velocity and the turbulence level of the liquid and solid particles in a supersonic air flows. (Modified author abstract) GRA

N74-34720# Michigan Univ., Ann Arbor. Dept. of Naval Architecture and Marine Engineering.
LASER DOPPLER VELOCIMETER EVALUATION AND MEASUREMENT IN A FLOW WITH DRAG REDUCTION Ph.D. Thesis
Peter David Fitzgerald 1974 88 p refs Sponsored in part by ONR, Arlington, Va.
(AD-783700) Avail: NTIS CSCL 20/4

Drag reduction, effects of polymer degradation and mean flow characteristics of a series of drag reducing polymer flows using tap water as the solvent were obtained using a laser Doppler velocimeter and a pressure transducer. A closed-loop flow system, using a centrifugal pump for recirculation of the flow, allowed a study of the degradation of the 10, 20, 40, 50 and 100 ppm concentrations of Separan AP-30 polymer injected into the flow. Results indicate a significant degradation for all concentrations after just one pass through the flow system. For subsequent passes through the system the non-linear degradation of the polymer flow is observed asymptotically approaching the wall shear stress value of water. Velocity profiles at maximum drag reduction for 10, 20 and 40 ppm concentrations were obtained. An analysis of the optical system used was presented. A complete description of the signal processing system was given. GRA

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N74-34721 Oklahoma Univ., Norman.
OPTIMAL SAMPLING OF A STRATOSPHERIC SUDDEN

WARMING Ph.D. Thesis
Marvin Dale Kays 1974 159 p
Avail: Univ. Microfilms Order No. 74-19253

A stratospheric sudden warming is represented by an exponential function where observations of the stratospheric sudden warming contain the signal plus random noise. A covariance function of the observation was found by taking expected values over both the noise and random variables in the signal function. Sequential sampling was used to determine optimal sampling location and times. The advantages of sequential rather than simultaneous sampling are emphasized. An altitude and analysis time are specified for the sudden warming, and optimal station locations and sample times were computed. Similar patterns were noted when the simulated expected average signal was compared with the 5, 10, and 30 mb isotherm patterns obtained during an actual sudden warming. Dissert. Abstr.

N74-34722 California Univ., Berkeley
AURORAL ZONE ELECTRIC CURRENT MEASUREMENTS ON SOUNDING ROCKETS Ph.D. Thesis
Edgar Andrew Bering, III 1974 212 p
Avail: Univ. Microfilms Order No. 74-20280

A split Langmuir probe was developed to make in situ measurements of ionospheric current density and plasma bulk flow. The split Langmuir probe consists of two conducting elements that are separated by a thin insulator that shield each other over a 2 pi solid angle, and that are simultaneously swept from negative to positive with respect to the plasma. Information is obtained on the plasma's current density, bulk flow, electron temperature, and density by measuring the current to each plate and the difference of the currents between the plates. Sources of error limiting complete measurement of all of these parameters include plate area differences, plate work function differences, input electronics differences, and probe wake effects. The instrument was successfully flown four times on sounding rockets into auroral events near local midnight. Dissert. Abstr.

N74-34723* + National Aeronautics and Space Administration, Washington, D.C.
EARTH RESOURCES: A CONTINUING BIBLIOGRAPHY WITH INDEXES, ISSUE 1
Jun. 1974 147 p refs
(NASA-SP-7041(01)) Avail: NTIS HC $4.00 CSCL 05B

This bibliography lists 616 reports, articles, and other documents introduced into the NASA scientific and technical information system between January 1974 and March 1974. Emphasis is placed on the use of remote sensing and geophysical instrumentation in spacecraft and aircraft to survey and inventory, natural resources and urban areas. Subject matter is grouped according to agriculture and forestry, environmental changes and cultural resources, geodesy and cartography, geology and mineral resources, oceanography and marine resources, hydrology and water management, data processing and distribution systems, instrumentation and sensors, and economic analysis. Author

N74-34724 Saskatchewan Univ., Saskatoon.
SPECTROSCOPIC STUDIES OF ATOMIC OXYGEN IN THE EARTH'S ATMOSPHERE: TWILIGHT AND DAY AIRGLOW, DAYTIME AURORA AND VERTICAL MASS MOTIONS IN AN AURORA Ph.D. Thesis
Steven Peteherych 1973 224 p
Avail: Univ. Microfilms Order No. 74-23212

The development of a dual-etalon Fabry-Perot spectrometer was completed. It has a spectral resolution of about 0.03 A, sufficient for Doppler temperature measurements of atomic species in the atmosphere as well as providing background discrimination for twilight and day airglow studies of atomic oxygen. Incorporating simultaneous ten channel spatial scanning and pulse counting provided adequate sensitivity to readily measure night airglow intensities of about 40 R with a time resolution of the order of 100 to 200 sec. A least squares method for the analysis of data obtained with spatially scanned spectrometers was developed. It was used to determine Doppler temperatures and Doppler shifts of the OI 5577 A emission line in aurora. Doppler shifts in line position were related to net mass motions of the emitting species. The method may be employed to yield these parameters separately or simultaneously. Dissert. Abstr.

N74-34725 Rice Univ., Houston, Tex.
LIGHTNING CHANNEL STRUCTURE INSIDE AN ARIZONA THUNDERSTORM Ph.D. Thesis
Thomas Leon Teer 1974 270 p
Avail: Univ. Microfilms Order No. 74-21344

The time development and spatial distribution of lightning channels in the dissipating stage of an Arizona thunderstorm is investigated and results are compared to existing observations and theories of the dynamics of cloud electrification. Thunder sound ranging techniques were used to determine the lightning channel geometry of 17 cloud-to-ground and 20 intracloud discharges inside the thunderstorm. These techniques involved the simultaneous measurement of the acoustic profile of thunder at several locations and the use of ray tracing techniques to track arriving waves back to their source regions. The theoretical justification of the technique and its inherent limitations are explored and used to interpret resulting acoustic lightning reconstructions. A variance analysis of the acoustic reconstructions was done to extract meaningful statistics concerning cloud electrification. Dissert. Abstr.

N74-34726 Rice Univ., Houston, Tex.
A MODEL CURRENT SYSTEM ASSOCIATED WITH MULTIPLE AURORAL ARCS Ph.D. Thesis
Jean Sesiano 1974 192 p
Avail: Univ. Microfilms Order No. 74-21330

A rocket-borne experiment comprising a vector magnetometer and an array of particle detectors to study the currents and precipitating particles associated with multiple auroral arcs was conducted at Poker Flats, Alaska, on February 2, 1972. The magnetometer measured the magnetic field as the payload passed over the arc system (visual intensity about 20 kR). From the changes in the magnitude and direction of the field, it was possible to build a system of electrojets and Birkeland (field-aligned) currents. Two models were compatible with the data. The first model consisted of four pairs fo current sheets, three of them corresponding to visible arcs, aligned in a magnetic east-west direction, of current densities; two eastward and one westward electrojet of current magnitude between 1000 and 2000 amperes were also present. Dissert. Abstr.

N74-34727 Miami Univ., Coral Gables, Fla.
ATMOSPHERIC TRITIUM-BUDGET, DISTRIBUTION, AND TRACER APPLICATIONS Ph.D. Thesis
Allen Smith Mason 1974 72 p
Avail: Univ. Microfilms Order No. 74-23404

A program of development of instrumentation for sampling tritium as tritiated water (HTO) and tritiated free hydrogen (HT) in the upper troposphere and lower stratosphere was carried out. The equipment was utilized on a number of sampling flights. The resulting data indicated that HTO mixing ratios are typical of the source regions of the air, and that water turnover times increase exponentially upward between the tropopause and the ca. 150 mb level. This region exhibits a characteristic time of two years. The HTO mixing ratio ceases to increase in the middle stratosphere. Nearly uniform vertical profiles of the HT mixing ratio were found, except during periods of perturbation by underground nuclear weapons testing. The upper tropospheric HT mixing ratio was used to parameterize the interhemispheric air exchange time and the chemical hydrogen lifetime.
Dissert. Abstr.

N74-34728 Colorado Univ., Boulder.
DETERMINATION OF ATOMIC OXYGEN DENSITY FROM A ROCKET BORNE MEASUREMENT OF THE HYDROXYL INFRARED AIRGLOW Ph.D. Thesis
Robert Earl Good 1974 119 p
Avail: Univ. Microfilms Order No. 74-22344

Atomic oxygen densities in the 80 to 90 km altitude range were determined from a rocket borne observation of the hydroxyl radical, OH, infrared airglow. The observed nighttime column emission was numerically differentiated to determine the volume emission of the OH molecules. A model is developed relating the hydroxyl emission rate to the atomic oxygen density for the 80 to 90 km altitude region on the basis of: (1) the ozone and hydroxyl densities are in photochemical equilibrium; (2) the hydroxyl emission observed is produced by the H + O3 reaction, (3) the H + O3 reaction is the principal ozone destruction

reaction; and (4) the ozone destruction is balanced by the ozone formation reaction, O + O2 + M. On the basis of these assumptions, the observed hydroxyl emission is proportional to the local atomic oxygen density. Dissert. Abstr.

N74-34729 California Univ., Davis.
MODAL SIMPLIFICATION OF A SYSTEM OF BILATERALLY COUPLED DIFFUSIVE ELEMENTS: WITH APPLICATIONS TO GLOBAL ATMOSPHERIC POLLUTANT TRANSPORT PROBLEMS Ph.D. Thesis
Jeffrey William Young 1974 229 p
Avail: Univ. Microfilms Order No. 74-21641

The separation of variables and eigenfunction expansion techniques are shown to be applicable to distributed parameter systems not normally analyzed by these classical techniques. In particular, examples are considered for the process of diffusion occurring: (1) in a non-homogeneous medium; (2) in a system of interacting elements; and (3) in a region with a boundary condition which changes from the Dirichlet to the Neuman condition at a point along a coordinate surface. The approach in general is to subdivide the region into subregions for which separation of variables may be applied. The techniques are applied in the development of a preliminary speculative model of the global transport of atmospheric pollutants. Turbulent mixing is assumed to govern the transport within four interacting compartments - a stratosphere and troposphere in the Northern and Southern Hemispheres. Dissert. Abstr.

N74-34730 Alaska Univ., College.
GEOMAGNETIC INFLUENCES ON THERMOSPHERIC WINDS OBSERVED IN THE AURORAL ZONE Ph.D. Thesis
Donald Douglas James Herbert Wallis 1974 249 p
Avail: Univ. Microfilms Order No. 74-20867

A large body of observations of the wind field in the high-latitude thermosphere (140 to 350 km) is examined to characterize the winds and to determine their probable source. Theories and existing models of these winds are reviewed. The morphologies of auroral particle precipitation, electric fields, and current systems are discussed to elucidate the effects of these factors upon the wind field. Existing models suggest that the effects of auroral electric fields and heating can be separated in a geomagnetic coordinate frame. It is shown, that the mean temporal dependence of the (geomagnetic) meridional component is similar to that predicted by tidal models except the magnitudes of the observed winds are smaller than predicted. Deviations (up to 200 m/sec) of the observed meridional winds from this mean behavior are probably caused by heating of the thermosphere by Joule dissipation in the auroral electrojets. Dissert. Abstr.

N74-34731 Case Western Reserve Univ., Cleveland, Ohio.
A NUMERICAL MODEL FOR WIND DRIVEN CIRCULATION AND TEMPERATURE FIELDS IN LAKES AND PONDS Ph.D. Thesis
Subrata Sengupta 1974 248 p
Avail: Univ. Microfilms Order No. 74-22092

The model was used for a rectangular basin of 100M x 100M extent with a constant depth of 4M. This approximates the Squire Vallevue Farm pond, which is part of an ecosystems project located a few miles East of Cleveland. The effects of various wind stresses, surface heat transfer, and eddy coefficients were investigated. The model was used for a constant depth rectangular approximation of the central basin of Lake Erie. The results indicate the applicability of the program for flows where Coriolis forces are dominant. A vertically stretched system of equations which mapped a variable depth domain to constant depth was used to obtain solutions for variable depth basins. The model was applied to find the solutions for Squire Vallevue Farm pond, with its irregular boundary and variable bottom topography. Steady state velocities were obtained and the effects of heating through the surface were investigated. Dissert. Abstr.

N74-34732*# Argus Exploration Co., Los Angeles, Calif.
A RECONNAISSANCE SPACE SENSING INVESTIGATION OF CRUSTAL STRUCTURE FOR A STRIP FROM THE EASTERN SIERRA NEVADA TO THE COLORADO PLATEAU Final Report
Mark A. Liggett, Principal Investigator Aug. 1974 478 p refs Original contains color illustrations. Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21809)
(E74-10705; NASA-CR-139434) Avail: NTIS HC $27.00 CSCL 08G

The author has identified the following significant results. Studies were conducted in key field areas in the Sierra Nevada, the Basin Range Province and the Colorado Plateau to evaluate the origins and significance of geologic and structural anomalies expressed in the ERTS-1 data. The investigation included development of image enhancement and analysis techniques and comparison of remote sensing data available over the test site. The ERTS-1 MSS imagery has proven to be an effective tool for studying the interrelationsships between Cenozoic tectonic patterns and the distributions of Cenozoic plutonism and volcanism, seismic activity, geologic hazards, and known mineral, geothermal and ground water resources. Recommendations are made for applications of ERTS-1 data to natural and resource exploration and management.

N74-34733*# Mississippi State Univ., State College.
A STUDY FOR THE APPLICATION OF REMOTE SENSING DATA TO LAND USE PLANNING ON THE MISSISSIPPI GULF COAST Final Report, Sep. 1972 - Aug. 1974
F. M. Ingels, Principal Investigator, R. W. Boyd, E. Bryant, B. T. Chapin, R. T. Jones, and C. W. Bouchillon Aug. 1974 60 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21817)
(E74-10733; NASA-CR-139623) Avail: NTIS HC $4.25 CSCL 08B

There are no author-identified significant results in this report.

N74-34734*# Imperial Government of Iran, Tehran.
AN EVALUATION OF THE UTILITY OF ERTS-1 DATA FOR MAPPING AND DEVELOPING NATURAL RESOURCES OF IRAN Final Report
K. Ebtehadj, Principal Investigator Jul. 1974 211 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E74-10758; NASA-CR-139998) Avail: NTIS HC $13.75 CSCL 08B

The author has identified the following significant results. Results are reported in structural mapping leading to tectonic interpretation; in surficial deposits mapping; in analysis of salt diapirism in southwest Iran; in updating and correcting existing hydrological maps; in monitoring fluctuations of water in some intermittent lakes; in the delineation of wetland areas and the study of fluvial suspended load of the head of the Persian Gulf in relation to the fishing industry; in exercises in soil mapping; in range and agricultural surveys and inventory using multistage sampling methods, and in the computer analysis of ERTS-1 digital tapes for urban land use. The completion of a 1:1,000,000 false color photomosaic of Iran is also discussed.

N74-34735*# Agricultural Research Service, Weslaco, Tex.
IRRIGATION SCHEDULING, FREEZE WARNING AND SOIL SALINITY DETECTING Monthly Progress Report, Sep. 1974
Craig L. Wiegand, Principal Investigator Sep. 1974 2 p EREP
(NASA Order T-4105-B)
(E74-10768; NASA-CR-140121; MPR-9) Avail: NTIS HC $3.25 CSCL 02C

There are no author-identified significant results in this report.

N74-34736*# Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.
INVENTORY OF FOREST AND RANGELAND RESOURCES, INCLUDING FOREST STRESS Bimonthly Progress Report, 16 Jul. - 15 Sep. 1974
Robert C. Aldrich, Frederick P. Weber, and Richard S. Driscoll,

Principal Investigators 20 Sep. 1974 6 p EREP
(NASA Order T-4106-B)
(E74-10769; NASA-CR-140122; BMPR-13) Avail: NTIS HC $3.25 CSCL 02F

The author has identified the following significant results. Road systems being developed within the Manitou, Colorado area for human habitation are readily discernible on the S192 normal-color photographs. These are dirt roads, some of which are about 20 feet wide. These data should provide the District Ranger of the Pike National Forest required information on the size and extent of these developing areas, information which he does not now have but is required for total management of the District.

N74-34737*# South Dakota State Univ., Brookings. Remote Sensing Inst.
DEVELOP TECHNIQUES AND PROCEDURES, USING MULTISPECTRAL SYSTEMS, TO IDENTIFY FROM REMOTELY SENSED DATA THE PHYSICAL AND THERMAL CHARACTERISTICS OF PLANTS AND SOIL Monthly Progress Report, Aug. 1974
Victor I. Myers, Principal Investigator 20 Sep. 1974 2 p EREP
(Contract NAS9-13337)
(E74-10770; NASA-CR-140123) Avail: NTIS HC $3.25 CSCL 08F

There are no author-identified significant results in this report.

N74-34738*# Northern Prairie Wildlife Research Center, Jamestown, N. Dak.
UTILIZATION OF SKYLAB (EREP) SYSTEM FOR APPRAISING CHANGES IN CONTINENTAL MIGRATORY BIRD HABITAT Monthly Progress Report, Sep. 1974
David S. Gilmer, Principal Investigator Sep. 1974 2 p EREP (NASA Order T-4114-B)
(E74-10771; NASA-CR-140124) Avail: NTIS HC $3.25 CSCL 06C

There are no author-identified significant results in this report.

N74-34739*# North Carolina State Univ., Raleigh. Dept of Geosciences.
UTILIZATION OF EREP DATA IN GEOLOGICAL EVALUATION, REGIONAL PLANNING, FOREST MANAGEMENT, AND WATER MANAGEMENT IN NORTH CAROLINA Quarterly Progress Report, Jun. - Aug. 1974
Charles W. Welby, Principal Investigator 27 Sep. 1974 2 p EREP
(Contract NAS9-13321)
(E74-10772; NASA-CR-140125) Avail: NTIS HC $3.25 CSCL 08B

There are no author-identified significant results in this report.

N74-34740*# National Oceanic and Atmospheric Administration, Miami, Fla.
REMOTE SENSING OF PACIFIC HURRICANE AND RADIOMETRIC MEASUREMENTS FROM FOAM AND SLICKS Progress Report
Duncan Ross, Principal Investigator, B. Au, W. Brown, J. McFadden, J. Kenney, and L. Martin 31 Jul. 1974 31 p refs EREP
(NASA Order T-4644-B)
(E74-10773; NASA-CR-140126) Avail: NTIS HC $3.75 CSCL 04B

There are no author-identified significant results in this report.

N74-34741*# Institut Francais du Petrole, Rueil-Malmaison.
PROJECT PYRALP: TECTONICS RELATIONSHIPS BETWEEN PYRENEES AND ALPS (SOUTHERN FRANCE) Progress Report, Jun. - Jul. 1974
Jacques Guillemot, Principal Investigator Aug. 1974 19 p refs Sponsored by NASA EREP
(E74-10774; NASA-CR-140127; PR-4) Avail: NTIS HC $3.25 CSCL 08G

The author has identified the following significant results. In the Eastern Aquitaine Basin in southern France, investigations using SL 3 photographs from an S190A camera reveal a slight line joining a Paleozoic trend of the Montagne Noire massif to a more recent Pyrenean fault zone of Cretaceous to Tertiary age. According to the interpretation of this line as the superficial geomorphological trace of a deep-seated fault zone, Hercynian weakness lines appear to have played a more important part than previously thought in the building of the Pyrenean range. The Lezat line is a trend of small morphological features obvious only in the photographs having the highest resolution.

N74-34742*# Consiglio Nazionale delle Ricerche, Milan (Italy). Lab. per la Geofisica della Litosfera.
CONTRIBUTION OF SKYLAB MULTISPECTRAL IMAGERY TO THE REMOTE SENSING STUDIES OF MOUNT ETNA VOLCANO Progress Report
R. Cassinis, Principal Investigator, G. M. Lechi, C. M. Marino, and A. M. Tonelli 26 Sep. 1974 9 p Sponsored by NASA EREP
(E74-10775; NASA-CR-140128; PR-3) Avail: NTIS HC $3.25 CSCL 08F

There are no author-identified significant results in this report.

N74-34743*# Kansas Univ. Center for Research, Inc., Lawrence. Space Technology Center.
KANSAS ENVIRONMENTAL AND RESOURCE STUDY: A GREAT PLAINS MODEL. MONITORING FRESH WATER RESOURCES Final Report, 1 Aug. 1972 - 24 Mar. 1974
Harold L. Yarger, Principal Investigator and James R. McCauley Mar. 1974 60 p refs ERTS
(Contract NAS5-21822)
(E74-10776; NASA-CR-140129; Rept-2265-10) Avail: NTIS HC $6.00 CSCL 08H

The author has identified the following significant results. ERTS MSS ratios derived from CCT's are very effective for quantitative detection of suspended solid up to at least 900 ppm. The relatively high inorganic suspended solids, characteristic of midcontinent reservoirs, dominates the reflected energy present in the four MSS bands. Dissolved solids concentrations up to 500 ppm and algal nutients up to 20 ppm are not detectable. The MSS5/MSS4 ratio may be weakly correlated with total chlorophyll above approximately 8 micrograms/liter.

N74-34744*# Cochise County Planning Dept., Bisbee, Ariz.
APPLICATION OF REMOTE SENSING TECHNIQUES IN LAND-USE PLANNING: FLOOD-PLAIN DELINEATION
Jim Altenstadter, Principal Investigator and Robin B. Clark Sep. 1974 28 p refs Original contains color illustrations. Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21807)
(E74-10777; NASA-CR-140130) Avail: NTIS HC $3.75 CSCL 08B

The delineation of areas subject to inundation by means of remotely-sensed data acquisition represents a considerable saving in personnel time. Repeated input from aerial sensor sources provides the planner with a potent tool for the formation of a data base and for the monitoring of land use patterns over a period of time. The primary output of this project was a set of base map overlays at a scale of 1:62,500 delineating areas which require special regulations when proposed for land use involving human habitation or certain classes of storage. A secondary product of the study was county-wide maps of watershed configurations and of soil hydrologic groups. Further research is anticipated to extend the mapping of watershed areas outside the political boundaries of Cochise County, which will provide data for subsequent rainfall-runoff relationship studies in the area. All of the data provided will be incorporated into the Cochise County composite computer mapping project now operational. Results of this project have improved the pool of information available to the planning staff of Cochise County.

N74-34745*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
AN INTERDISCIPLINARY ANALYSIS OF MULTISPECTRAL SATELLITE DATA FOR SELECTED COVER TYPES IN THE

COLORADO MOUNTAINS, USING AUTOMATIC DATA PROCESSING TECHNIQUES Monthly Progress Report, Aug. 1974
Roger M. Hoffer, Principal Investigator Aug. 1974 5 p EREP (Contract NAS9-13380)
(E74-10778; NASA-CR-140131) Avail: NTIS HC $3.25 CSCL 08F

There are no author-identified significant results in this report.

N74-34746*# Katholieke Universiteit te Leuven (Belgium). Dept. Geografie-Geologie.
LAKE TCHAD AND ZAIRE BASINS AND SURROUNDING AREAS: REGIONAL-GEOGRAPHIC AND GEOMORPHIC ANALYSES USING ERTS-SATELLITE IMAGERY
J. Stercky, Principal Investigator 1974 9 p refs Sponsored by NASA ERTS
(E74-10779; NASA-CR-140132) Avail: NTIS HC $4.00 CSCL 08F

There are no author-identified significant results in this report.

N74-34747*# Katholieke Universiteit te Leuven (Belgium). Lab. voor Experimentele Geomorfologie en Tropische Streken.
LAKE TCHAD AND ZAIRE BASINS AND SURROUNDING AREAS: REGIONAL-GEOGRAPHIC AND GEOMORPHIC ANALYSES USING ERTS-SATELLITE IMAGERY
J. Sterckx, Principal Investigator 1974 12 p refs Sponsored by NASA ERTS
(E74-10780; NASA-CR-140133; Rept-3) Avail: NTIS HC $3.25 CSCL 08F

There are no author-identified significant results in this report.

N74-34748*# Hunting Surveys, Ltd., Boreham Wood (England).
CARTOGRAPHIC RESEARCH IN EREP PROGRAMME FOR SMALL SCALE MAPPING
P. G. Mott, Principal Investigator 12 Aug. 1974 3 p Sponsored by NASA EREP
(E74-10781; NASA-CR-140134) Avail: NTIS HC $3.25 CSCL 08B

There are no author-identified significant results in this report.

N74-34749*# Environmental Research and Technology, Inc., Lexington, Mass.
STUDY TO DEVELOP IMPROVED SPACECRAFT SNOW SURVEY METHODS USING SKYLAB/EREP DATA Quarterly Progress Report, 15 Jun. - 15 Sep. 1974
James C. Barnes, Principal Investigator Sep. 1974 5 p EREP (Contract NAS9-13305)
(E74-10782; NASA-CR-140135; QPR-6) Avail: NTIS HC $3.25 CSCL 08L

There are no author-identified significant results in this report.

N74-34750*# Earth Science Research Corp., Santa Monica, Calif.
FAULT TECTONICS AND EARTHQUAKE HAZARDS IN THE PENINSULAR RANGES, SOUTHERN CALIFORNIA Monthly Progress Report, Aug. 1974
Paul M. Merifield, Principal Investigator 5 Sep. 1974 2 p EREP
(Contract NAS2-7698)
(E74-10783; NASA-CR-140136; MPR-15) Avail: NTIS HC $3.25 CSCL 08E

There are no author-identified significant results in this report.

N74-34751*# Naval Research Lab., Washington, D.C.
TERRAIN PROPERTIES AND TOPOGRAPHY FROM SKYLAB ALTIMETRY Monthly Progress Report, Jul. 1974
Allan Shapiro, Principal Investigator 16 Sep. 1974 2 p EREP
(NASA Order T-4716-B)
(E74-10784; NASA-CR-140137) Avail: NTIS HC $4.00 CSCL 08E

There are no author-identified significant results in this report.

N74-34752*# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
DESIGN DATA COLLECTION WITH SKYLAB/EREP MICROWAVE INSTRUMENT S-193 Monthly Letter Progress Report No. 12, Aug. 1974
Richard K. Moore, Fawwaz T. Ulaby, Principal Investigators, Arun Sobti, John C. Barr, Evan Davison, Chia Sung, Saad Ulaby, and Tom Burton Aug. 1974 6 p EREP
(Contract NAS9-13331)
(E74-10785; NASA-CR-140138) Avail: NTIS HC $4.00 CSCL 14B

There are no author-identified significant results in this report.

N74-34753*# Dartmouth Coll., Hanover, N.H. Dept. of Geography.
INVESTIGATION OF LAND USE OF NORTHERN MEGALOPOLIS USING ERTS-1 IMAGERY Supplementary Report, 15 Dec. 1973 - 15 Jun. 1974
Robert B. Simpson, Principal Investigator, David T. Lindgren, and William Goldstein Jul. 1974 54 p Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21749)
(E74-10786; NASA-CR-140139; S113-116) Avail: NTIS HC $5.75 CSCL 08B

The author has identified the following significant results. It was concluded that ERTS land use mapping, in spite of portraying megalopolis more accurately and dramatically than the best past efforts, is in danger of falling into the category of being too revolutionary for many planners and too conventional for many electronics engineers. Two alternative solutions are implied: one is to improve the ERTS product to the level where it will be completely accepted by planners, and the other is to increase support for the present somewhat primitive product through education, cost-sharing, and legislation.

N74-34754*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
YELLOWSTONE NATIONAL PARK MAPPING FROM ERTS-1 COMPUTER COMPATIBLE TAPES Final Report, May 1972 - May 1974
F. J. Thomson, Principal Investigator and N. E. Roller Sep. 1974 35 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21783)
(E74-10787; NASA-CR-140140; ERIM-193300-50-F) Avail: NTIS HC $4.75 CSCL 08B

There are no author-identified significant results in this report.

N74-34755*# Consiglio Nazionale delle Ricerche, Milan (Italy). Lab. per la Geofisica della Litosfera.
SKYLAB MULTISPECTRAL PHOTOGRAPHY OF ITALIAN VOLCANOLOGY, GEOLOGY, RICE FIELDS, AND PALEO RIVER BEDS Progress Report
R. Cassinis, Principal Investigator 6 Jun. 1974 9 p Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(E74-10788; NASA-CR-140141; PR-2) Avail: NTIS HC $3.25 CSCL 08F

There are no author-identified significant results in this report.

N74-34756*# Consiglio Nazionale delle Ricerche, Milan (Italy). Lab. per la Geofisica della Litosfera.
SKYLAB MULTISPECTRAL PHOTOGRAPHY OF ITALIAN VOLCANOLOGY, GEOLOGY, RICE FIELDS, AND PALEO RIVER BEDS Progress Report
R. Cassinis, Principal Investigator, G. M. Lechi, C. M. Marino, and A. M. Tonelli 9 May 1974 3 p Sponsored by NASA EREP

(E74-10789; NASA-CR-140142; PR-1) Avail: NTIS HC $3.25 CSCL 08F

There are no author-identified significant results in this report.

N74-34757*# Agricultural Research Service, Weslaco, Tex.
IRRIGATION SCHEDULING, FREEZE WARNING AND SOIL SALINITY DETECTING Monthly Progress Report, Jul. 1973
Craig L. Wiegand, Principal Investigator Aug. 1973 1 p EREP
(NASA Order T-4105-B)
(E74-10790; NASA-CR-140143; MPR-2) Avail: NTIS HC $4.00 CSCL 02C

There are no author-identified significant results in this report.

N74-34758*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
APPLICATION OF ERTS AND EREP IMAGES TO GEOLOGIC INVESTIGATIONS OF THE BASIN AND RANGE: COLORADO PLATEAU BOUNDARY IN NORTHWESTERN AND NORTH-CENTRAL ARIZONA Progress Report, 15 Aug. 1973 - 15 Sep. 1974
A. F. H. Goetz, Principal Investigator, F. C. Billingsley, D. P. Elston (US Geological Survey, Flagstaff, Ariz.), I. Lucchita (US Geological Survey, Flagstaff, Ariz.), and E. M. Shoemaker (California Inst. of Technology, Pasadena) 15 Sep. 1974 10 p Sponsored by NASA ERTS
(E74-10791; NASA-CR-140144) Avail: NTIS HC $4.00 CSCL 08G

The author has identified the following significant results. In the course of the ERTS investigation in the Cataract Creek Basin of the Coconino Plateau it was recognized that shallow perched ground water associated with the Kaibab Limestone could be discovered by means of drilling guided by geologic mapping aided by the use of ERTS imagery. At the Globe Ranch, the perched water table is only 5 meters beneath the surface at the site of the original, hand dug well. Recharge occurs from local runoff and from direct precipitation on the outcrop belt of the sandstone. This well provides water for the ranch at the rate of about 1,000 gallons a week. In order to explore the possibility of further developing this aquifer, unit 5 was mapped over an area of about 50 square miles in the vicinity of the hand-dug well, with negative results. A new location was then picked for drilling based on the occurrence of unit 5 in a favorable structural setting. This location was along a normal fault, and it was anticipated that water might be structurally trapped within the down-dropped block of the fault. Four shallow testholes were drilled and all encountered water. These four water-bearing holes are currently being monitored and will be tested to determine potential production of water from the local sandstone aquifer.

N74-34759*# TRW Systems Group, Redondo Beach, Calif.
EVALUATION OF DIGITAL CORRECTION TECHNIQUES FOR ERTS IMAGES Final Report, Aug. 1972 - Feb. 1973
S. S. Rifman, Principal Investigator and D. M. McKinnon Jul. 1974 83 p refs ERTS
(Contract NAS5-21814)
(E74-10792; NASA-CR-140145) Avail: NTIS HC $7.25 CSCL 14E

There are no author-identified significant results in this report.

N74-34760*# Colorado School of Mines, Golden. Dept. of Geology.
GEOLOGIC AND MINERAL AND WATER RESOURCES INVESTIGATIONS IN WESTERN COLORADO, USING SKYLAB EREP DATA Monthly Progress Report
Keenan Lee, Principal Investigator 27 Sep. 1974 6 p EREP
(Contract NAS9-13394)
(E74-10793; NASA-CR-140146) Avail: NTIS HC $3.25 CSCL 08G

There are no author-identified significant results in this report.

N74-34761*# Environmental Research Inst. of Michigan, Ann Arbor.
STUDY OF RECREATIONAL LAND AND OPEN SPACE USING SKYLAB IMAGERY Monthly Progress Report
Irvin J. Sattinger, Principal Investigator 15 Sep. 1974 2 p EREP
(Contract NAS9-13283)
(E74-10794; NASA-CR-140147; ERIM-103300-33-L) Avail: NTIS HC $3.25 CSCL 08B

There are no author-identified significant results in this report.

N74-34762*# Environmental Research Inst. of Michigan, Ann Arbor.
DEVELOPING PROCESSING TECHNIQUES FOR SKYLAB DATA Monthly Progress Report, Aug. 1974
Richard F. Nalepka and William A. Malila, Principal Investigators 17 Sep. 1974 2 p EREP
(Contract NAS9-13280)
(E74-10795; NASA-CR-140148; ERIM-101900-38-L) Avail: NTIS HC $3.25 CSCL 05B

There are no author-identified significant results in this report.

N74-34763*# Army Construction Engineering Research Lab., Champaign, Ill.
EFFECTS OF CONSTRUCTION AND STAGED FILLING OF RESERVOIRS ON THE ENVIRONMENT AND ECOLOGY Bimonthly Progress Report, 9 Aug. - 8 Oct. 1974
R. K. Jain, Principal Investigator 8 Oct. 1974 1 p ERTS
(NASA Order S-70255-AG)
(E74-10796; NASA-CR-140149) Avail: NTIS HC $3.25 CSCL 08H

There are no author-identified significant results in this report.

N74-34764*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
USE OF COMPUTER-AIDED ANALYSIS TECHNIQUES FOR COVER TYPE MAPPING IN AREAS OF MOUNTAINOUS TERRAIN
Roger M. Hoffer, Principal Investigator, Michael D. Fleming, and Paula V. Krebs (Colorado Univ., Boulder) 27 Aug. 1974 15 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21880; Grant NGL-15-005-112)
(E74-10797; NASA-CR-140150) Avail: NTIS HC $4.00 CSCL 08B

There are no author-identified significant results in this report.

N74-34765*# Hunting Surveys, Ltd., Boreham Wood (England).
CARTOGRAPHIC RESEARCH IN EREP PROGRAMME FOR SMALL SCALE MAPPING Quarterly Report
P. G. Mott and J. D. Leatherdale, Principal Investigators 11 Oct. 1974 1 p Sponsored by NASA EREP
(E74-10798; NASA-CR-140428; QR-2) Avail: NTIS HC $3.25 CSCL 08B

There are no author-identified significant results in this report.

N74-34766*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
C-BAND STATION COORDINATE DETERMINATION FOR THE GEOS-C ALTIMETER CALIBRATION AREA
W. B. Krabill and S. M. Klosko (Wolf Research and Development Corp., Riverdale, Md.) Oct. 1974 81 p refs
(Contract NAS6-2173)
(NASA-TM-X-69356) Avail: NTIS HC $4.00 CSCL 08B

Dynamical orbital techniques were employed to estimate the center-of-mass station coordinates of six C-band radars located in the designated primary GEOS-C radar altimeter calibration area. This work was performed in support of the planned GEOS-C mission (December, 1974 launch). The sites included Bermuda, Grand Turk, Antigua, Wallops Island (Virginia), and Merritt Island (Florida). Two sites were estimated independently at Wallops Island yielding better than 40 cm relative height recovery, with better than 10 cm and 1 m (relative) recovery for phi and gamma respectively. Error analysis and comparisons with other investigators indicate that better than 2 m relative recovery was

achieved at all sites. The data used were exclusively that from the estimated sites and included 18 orbital arcs which were less than two orbital revolutions in length, having successive tracks over the area. The techniques employed here, given their independence of global tracking support, can be effectively employed to improve various geodetic datums by providing very long and accurate baselines. The C-band data taken on GEOS-C should be employed to improve such geodetic datums as the European-1950 using similar techniques. Author

N74-34767*# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
RADAR SPECTRAL MEASUREMENTS OF VEGETATION
Fawwaz T. Ulaby and Richard K. Moore Aug. 1973 20 p refs
(Contract NAS9-10261)
(NASA-CR-140289; CRES-TR-177-40) Avail: NTIS HC $4.00 CSCL 08F

Spectral data of 4-8 GHz radar backscatter were gathered during the 1972 growing season at look angles between 0 and 70 deg and for all four possible polarization linear combinations. The data covers four crop types (corn, milo, alfalfa, and soybeans) and a wide range of soil moisture content. To insure statistical representation of the results, measurements were conducted over 128 fields corresponding to a total of about 40,000 data points. The use of spectral response signatures to separate different crop types and to separate healthy corn from blighted corn was investigated. Author

N74-34768*# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
AGRICULTURAL TERRAIN SCATTEROMETER OBSERVATIONS WITH EMPHASIS ON SOIL MOISTURE VARIATIONS
C. King Aug. 1973 57 p refs
(Contract NAS9-10261)
(NASA-CR-140290; CRES-TR-177-44) Avail: NTIS HC $6.00 CSCL 08F

Airborne scatterometer observations were made for agricultural terrain in May and June, 1970 at a NASA test site near Garden City, Kansas. Data from 13.3 GHz and 400 MHz scatterometer were analyzed. It was observed that for incidence angle less than 40 degrees, the 13.3 GHz data showed a difference in backscatter from wet and dry fields of the order of 7 db. The averages of the various crop types were within a spread of only 5 db. Other ground parameters such as cultivation pattern and vegetation row effects showed even less distinguishing characteristics on the backscatter. The 400 MHz data also showed a slight moisture dependency. Author

N74-34769*# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
RADAR SIGNAL RETURN FROM NEAR-SHORE SURFACE AND SHALLOW SUBSURFACE FEATURES, DARIEN PROVINCE, PANAMA
Bradford C. Hanson and Louis F. Dellwig Aug. 1973 22 p refs
(Contract NAS9-10261)
(NASA-CR-140291; CRES-TR-177-39) Avail: NTIS HC $4.25 CSCL 17I

The AN/APQ-97 radar imagery over eastern Panama is analyzed. The imagery was directed toward extraction of geologic and engineering data and the establishment of operational parameters. Subsequent investigations emphasized landform identification and vegetation distribution. The parameters affecting the observed return signal strength from such features are considered. Near-shore ocean phenomena were analyzed. Tidal zone features such as mud flats and reefs were identified in the near range, but were not detectable in the far range. Surface roughness dictated the nature of reflected energy (specular or diffuse). In surf zones, changes in wave train orientation relative to look direction, the slope of the surface, and the physical character of the wave must be considered. It is concluded that the establishment of the areal extent of the tidal flats, distributary channels, and reefs is practical only in the near to intermediate range under minimal low tide conditions. Author

N74-34770# California Earth Science Corp., Santa Monica.
APPLICATION OF ERTS IMAGES TO STUDY OF ACTIVE AND POTENTIALLY ACTIVE FAULTS, SANTA BARBARA AREA, CALIFORNIA
D. L. Lamar and P. M. Merifield Sep. 1974 37 p refs
(Contract USGS-14-08-0001-13911)
(TR-74-3) Avail: NTIS HC $5.00 CSCL 08E

The ERTS images were utilized in the preparation of the seismic safety element for Santa Barbara County. All significant active faults can be recognized in the ERTS images, and 70 per cent of their total lengths can be readily traced. Major faults are commonly more easily traced on ERTS images than on larger scale (1:130,000) photos. Arguments are presented for a possible 44-mile (76 km) western extension of the Big Pine fault, first recognized as a prominent lineament in ERTS images. Author

N74-34771*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PHOTOGRAPHY FROM SPACE TO HELP SOLVE PROBLEMS ON EARTH
[1974] 19 p Original contains color illustrations
(NASA-TM-X-70333) Avail: NTIS HC $4.00 CSCL 14E

Varied uses of ERTS imagery are briefly discussed. Applications to mineral/land resources, environment, land use, water resources, maps/charts, marine resources, and agriculture/forestry/range resources are also provided. J.A.M.

N74-34772*# Virginia Inst. of Marine Science, Gloucester Point.
APPLICATION OF REMOTE SENSING TO STUDY NEAR-SHORE CIRCULATION Annual Report for Year 2
John Zeigler, Robert Lobecker, Donald Stauble, Christopher Welch, Larry Haas, and C. S. Fang Sep. 1974 96 p refs
(Grant NGL-47-022-005)
(NASA-CR-140189) Avail: NTIS HC $8.00 CSCL 80C

The research to use remote sensing techniques for studying the continental shelf is reported. The studies reported include: (1) nearshore circulation in the vincinity of a natural tidal inlet; (2) identification of indicators of biological activity; (3) remote navigation system for tracking free drifting buoys; (4) experimental design of an estuaring tidal circulation; and (5) Skylab support work. F.O.S.

N74-34773*# Texas A&M Univ., College Station. Remote Sensing Center.
DUAL FREQUENCY MICROWAVE RADIOMETER MEASUREMENTS OF SOIL MOISTURE FOR BARE AND VEGETATED ROUGH SURFACES
Siu Iim Lee Aug. 1974 230 p refs
(Grant NGL-44-001-001; Contract NAS9-13904)
(NASA-CR-140515; RSC-56) Avail: NTIS HC $14.50 CSCL 08M

Controlled ground-based passive microwave radiometric measurements on soil moisture were conducted to determine the effects of terrain surface roughness and vegetation on microwave emission. Theoretical predictions were compared with the experimental results and with some recent airborne radiometric measurements. The relationship of soil moisture to the permittivity for the soil was obtained in the laboratory. A dual frequency radiometer, 1.41356 GHz and 10.69 GHz, took measurements at angles between 0 and 50 degrees from an altitude of about fifty feet. Distinct surface roughnesses were studied. With the roughness undisturbed, oats were later planted and vegetated and bare field measurements were compared. The 1.4 GHz radiometer was less affected than the 10.6 GHz radiometer, which under vegetated conditions was incapable of detecting soil moisture. The bare surface theoretical model was inadequate, although the vegetation model appeared to be valid. Moisture parameters to correlate apparent temperature with soil moisture were compared. Author

N74-34774*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
GUIDEBOOK TO THE HAWAIIAN PLANETOLOGY CONFERENCE
Ronald Greeley, ed. (Santa Clara Univ., Calif.) Aug. 1974 256 p refs Presented at the Mars Geol. Mappers Meeting, Hilo, Hawaii, 1974; Sponsored by NASA
(NASA-TM-X-62362) Avail: NTIS HC $6.50 CSCL 08F

The role of volcanism in the geology of Hawaii is discussed in terms of origin, structure, and morphology. For individual titles, see N74-34775 through N74-34788.

N74-34775* Santa Clara Univ., Calif.
INTRODUCTION
Ronald Greeley *In* NASA. Ames Res. Center Guidebook to the Hawaiian Planetology Conf. Aug. 1974 p 1-13 refs (For availability see N74-34774 24-13)
CSCL 08F

Historical, geographical, and regional geological settings for the conference are presented that include volcanic stratigraphy, a photographic essay describing various landforms observed during eruptive activity at Kilauea Volcano, and a general discussion of the geology of the island of Hawaii. Also included are guides for field trips to interesting geographic features. G.G.

N74-34776* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A CONCISE HISTORY OF HAWAII
Cynthia R. Greeley *In* Its Guidebook to the Hawaiian Planetology Conf. Aug. 1974 p 15-18 refs (For availability see N74-34774 24-13)
CSCL 08F

The review outlines the early migration of Polynesian settlers from the Marquesa and Society Islands, develops the ancient societal hierachy, reports on the historic visits of Captain Cook, and describes the gradual weakening of the native culture and population by increased foreign trade and the final annexation of the islands by the United States of America. G.G.

N74-34777* Hawaii Univ., Honolulu. Dept. of Geology and Geophysics.
PHYSIOLOGRAPHY OF THE HAWAIIAN ISLANDS
Agatin T. Abbott *In* NASA. Ames Res. Center Guidebook to the Hawaiian Planetology Conf. Aug. 1974 p 20-22 ref (For availability see N74-34774 24-13)
CSCL 08F

Each of the eight principal Hawaiian Islands extending from Kauai on the northwestern end of the chain to Hawaii at the southeastern extremity represents the top of a great basaltic shield volcano that rises 4575 m above the ocean floor. The ages of the islands quite consistently decrease toward the southeast. Kauai is judged to be about 5.3 million years old, whereas Hawaii is less than 750,000 years in age. The ravages of time have had serious effects on the once domelike older volcanoes, so that the traditional shield shape is lost in a fretwork of peaks, ridges, palis, valleys, and plains. Age is not the only determinant of the degree of dissection by running water, waves, and chemical weathering. Another very important factor is the exposure of the particular side of island to excessive rainfall and mercilous trade-wind wave attack. The windward and high lee slopes receive 60 cm or more of rain annually, whereas the lower leeward slopes and coastal areas may receive 4 cm or less annually. Author

N74-34778* Geological Survey, Menlo Park, Calif.
ORIGIN OF THE HAWAIIAN ISLANDS
G. Brent Dalrymple, Eli A. Silver, and Everett D. Jackson *In* NASA. Ames Res. Center Guidebook to the Hawaiian Planetology Conf. Aug. 1974 p 23-36 refs Repr. from Amer. Sci., v. 61, no. 3, May-Jun. 1973 p 294-303 (For availability see N74-34774 24-13)
CSCL 08F

Recent studies indicate that the Hawaiian volcanic chain is a result of relative motion between the Pacific plate and a melting spot in the earth's mantle. Author

N74-34779* Portland State Univ., Oreg. Dept. of Earth Sciences.
SYNOPSIS OF VOLCANIC STRATIGRAPHY
Paul E. Hammond *In* NASA. Ames Res. Center Guidebook to the Hawaiian Planetology Conf. Aug. 1974 p 38-48 refs (For availability see N74-34774 24-13)
CSCL 08F

Volcanic stratigraphic units are mappable layered units composed of volcanic rocks that are formed on land (subaerially) or under water (subaqueously) by volcanic processes. At least ten different types of volcanic stratigraphic units are recognized. The characteristics for each are discussed briefly and some typical examples are illustrated by diagrams to show their salient features. Author

N74-34780* Geological Survey, Hawaii Volcanoes National Park.
RECENT LANDFORMS AT KILAUEU VOLCANO: A SELECTED PHOTOGRAPHIC COMPLIATION
Robin T. Holcomb, Donald W. Peterson, and Robert I. Tilling *In* NASA. Ames Res. Center Guidebook to the Hawaiian Planetology Conf. Aug. 1974 p 49-86 refs (For availability see N74-34774 24-13)
CSCL 08E

Recent eruptive activity at Kilauea has produced great changes in the landscape, modifying old landforms and creating new ones. Some of these landforms are observed fairly commonly in basaltic terrains, but many had rarely, if ever, been observed before in the process of development. The 1969-74 Mauna Ulu eruptions have provided the first historic opportunity at Kilauea to witness and record the development of features associated with flank activity of long duration. The photographs of new or modified landforms in this compilation place special emphasis on possible extraterrestrial analogs. Author

N74-34781* Hawaii Univ., Honolulu. Dept. of Geology and Geophysics.
GEOLOGY OF THE ISLAND OF HAWAII
Gordon A. Macdonald *In* NASA. Ames Res. Center Guidebook to the Hawaiian Planetology Conf. Aug. 1974 p 88-111 (For availability see N74-34774 24-13)
CSCL 08G

The account of the geology of the individual Hawaiian islands is only a progress report based very largely on the uppermost, visible parts of the Hawaiian volcanic range. The island of Hawaii today consists of five volcanic mountains. All of them are very young, and three of the volcanoes have been active in historic times. At least two other volcanoes which helped to build the island have been buried by more recent ones. Rocks exposed in the cliffs on the northeastern side of Kohala Mountain have been shown by the potassium-argon method to be about 700,000 years old. Author

N74-34782* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AERIAL RECONNAISSANCE OVER THE ISLAND OF HAWAII
Ronald Greeley (Santa Clara Univ., Calif.) *In* Its Guidebook to the Hawaiian Planetology Conf. Aug. 1974 p 113-183 refs (For availability see N74-34774 24-13)
CSCL 08B

The flight sequence in this guide is nominal and based on optimum weather conditions; it may be altered, depending upon weather and visibility. Also included at the end of the flight sequence for the island of Hawaii are sections for parts of Maui (Haleakala Volcano) and Molokai, which will be flown if Hawaii is completely obscured at flight time. Author

N74-34783* Santa Clara Univ., Calif.
ROAD GUIDE TO GEOLOGICAL POINTS OF INTEREST ON THE ISLAND OF HAWAII
H. T. Stearns, G. A. Macdonald, and Ronald Greeley *In* NASA. Ames Res. Center Guidebook to the Hawaiian Planetology Conf. Aug. 1974 p 185-197 Repr. from Geol. and Ground Water Resources, 1946, Hawaii Div. Hydrography Bull. 9, Plate 1 (For availability see N74-34774 24-13)
CSCL 08B

This road guide briefly describes the points of geologic interest along the main roads on Hawaii. It begins at Hilo and proceeds around the island in a clockwise direction on State Route 11 to Kailua, then returns to Hilo on State Route 19 to Hilo via Waimea, with side excursions on the other principal roads. Minimum excursion time is two days, allowing only very brief time for the various stops. The return to Hilo from Waimea can be made via Route 19 along the Hamakua Coast (wet, leeward side of island, displaying typical tropical erosion) or via Route 20 over the Humuula Saddle (high, relatively dry and cool; young volcanic features). Author

N74-34784* Geological Survey, Hawaii Volcanoes National Park.
FIELD GUIDE TO SUMMIT AREA AND UPPER EAST RIFT ZONE, KILAUEA VOLCANO, HAWAII
In NASA. Ames Res. Center Guidebook to the Hawaiian Planetology Conf. Aug. 1974 p 200-215 refs (For availability see N74-34774 24-13)
CSCL 08B

The field trip is divided into two sections: (1) Crater Rim Road; and (2) Chain of Craters Road. Most bibliographic references are omitted from the text, but a selected list of references to recent Hawaiian volcanic activity and to special studies is included. Author

N74-34785* Hawaii Univ., Honolulu. Inst. for Astronomy.
MAUNA IKI AND THE KAJU DESERT: KILAUEA VOLCANO, HAWAII
Dale P. Cruikshank *In* NASA. Ames Res. Center Guidebook to the Hawaiian Planetology Conf. Aug. 1974 p 217-231 refs (For availability see N74-34774 24-13)
(Grant NGL-12-001-057; Contract F19628-71-C-0008)
CSCL 08F

The Ka'u Desert lies southwest of Kilauea Volcano. The region contains some of the most interesting and best preserved volcanic features found in the islands. The structural setting and synopsis of recent volcanic activity on the Ka'u Desert are discussed here, and a field guide to Mauna Iki is provided. Author

N74-34786* Santa Clara Univ., Calif.
KAUMANA LAVA TUBE
Ronald Greeley *In* NASA. Ames Res. Center Guidebook to the Hawaiian Planetology Conf. Aug. 1974 p 233-238 refs (For availability see N74-34774 24-13)
CSCL 08F

The entrance to Kaumana Lava Tube is in a picnic ground next to Highway 20 (Kaumana Drive) about 6.5 km southwest of Hilo. The area is passed on the way to the Kona Coast via the Saddle Road and is identified by a Hawaii Visitors Bureau sign. Although it is not the largest lava tube in the islands, Kaumana Lava Tube is an interesting geological formation, displaying many of the features typical of lava tube interiors. It is accessible, relatively easy to walk through, and is in an excellent state of preservation. The tube developed in a historic lava flow (1881, from Mauna Loa), and many aspects of lava tube activity are observed. Author

N74-34787* Washington Univ., Seattle. Dept. of Geophysical Sciences.
MAUNA KEA
Stephen C. Porter *In* NASA. Ames Res. Center Guidebook to the Hawaiian Planetology Conf. Aug. 1974 p 239-246 refs (For availability see N74-34774 24-13)
CSCL 08F

Mauna Kea, the highest of Hawaii's five volcanoes, is the only high landmass in the central Pacific Ocean basin to bear unmistakable signs of Pleistocene glaciation. The stratigraphic record indicates that a summit ice cap formed and disappeared at least four times in the last 250,000 years, and that volcanic eruptions characterized not only the interglacial intervals, but also two of the glacial periods as well. Exposed rock units on the upper slopes of Mauna Kea have been divided into two major groups based on gross lithologic character. The Hamakua Group comprises the bulk of the subaerial shield of the volcano and consists largely of thin-bedded pahoehoe flows of olivine basalt. The overlying Laupahoehoe Group consists of a thin cap of alkalic lavas and pyroclastic layers confined largely to the upper slopes of the mountain. Interstratified with the volcanic units are sedimentary formations that provide evidence of four episodes of ice cap glaciation. Author

N74-34788* Hawaii Univ., Honolulu.
EAST PUNA
Gordon A. Macdonald *In* NASA. Ames Res. Center Guidebook to the Hawaiian Planetology Conf. Aug. 1974 p 248-257 refs (For availability see N74-34774 24-13)
CSCL 08F

This field trip mostly involves volcanic features that can be seen from roads in the east Puna District. Most of the features are associated with the eruptions of 1750(?), 1790(?), 1840, 1955, 1960, and the recent flows from Mauna Ulu on the Keauhou Lava Plains during the years 1969 to 1973. Particular emphasis is given to the 1955 and 1960 volcanic activity that occurred near the village of Kapoho. Author

N74-34789*# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.
FEASIBILITY STUDY OF A SWEPT FREQUENCY ELECTROMAGNETIC PROBE (SWEEP) USING INDUCTIVE COUPLING FOR THE DETERMINATION OF SUBSURFACE CONDUCTIVITY OF THE EARTH AND WATER PROSPECTING IN ARID REGIONS
Gerald A. LaTorraca and Lawrence H. Bannister Sep. 1974 111 p refs
(Grants NGL-22-001-019; AID/csd-3360)
(NASA-TM-X-70383; CSR-TR-74-3) Avail: NTIS HC $8.75

Techniques developed for electromagnetic probing of the lunar interior, and techniques developed for the generation of high power audio frequencies were combined to make practical a magnetic inductive coupling system for the rapid measurement of ground conductivity profiles which are helpful when prospecting for the presence and quality of subsurface water. A system which involves the measurement of the direction, intensity, and time phase of the magnetic field observed near the surface of the earth at a distance from a horizontal coil energized so as to create a field that penetrates the earth was designed and studied to deduce the conductivity and stratification of the subsurface. Theoretical studies and a rudimentary experiment in an arid region showed that the approach is conceptually valid and that this geophysical prospecting technique can be developed for the economical exploration of subterranean water resources. Author

N74-34790*# South Dakota State Univ., Brookings. Remote Sensing Inst.
USE OF REMOTE SENSING TECHNIQUES FOR INVENTORYING AND PLANNING UTILIZATION OF LAND RESOURCES IN SOUTH DAKOTA Annual Progress Report, Jul. 1973 - Jun. 1974
V. I. Myers, C. J. Frazee, A. E. Rusche, D. G. Moore, G. D. Nelson, and F. C. Westin Jun. 1974 96 p refs Original contains color illustrations
(Grant NGL-42-003-007)
(NASA-CR-140574; SDSU-RSI-74-08) Avail: NTIS HC $8.00
CSCL 08B

The basic procedures for interpreting remote sensing imagery to rapidly develop general soils and land use inventories were developed and utilized in Pennington County, South Dakota. These procedures and remote sensing data products were illustrated and explained to many user groups, some of whom are interested in obtaining similar data. The general soils data were integrated with land soils data supplied by the county director of equalization to prepare a land value map. A computer print-out of this map indicating a land value for each quarter section is being used in tax reappraisal of Pennington County. The land use data provided the land use planners with the present use of land in Pennington County. Additional uses of remote sensing applications are also discussed including tornado damage assessment, hail damage evaluation, and presentation of soil and land value information on base maps assembled from ERTS-1 imagery. Author

N74-34791# Bureau of Mines, Morgantown, W.Va. Energy Research Center.
RELATIONSHIPS OF EARTH FRACTURE SYSTEMS TO PRODUCTIVITY OF A GAS STORAGE RESERVOIR
W. K. Overbey, Jr., W. K. Sawyer, and B. R. Henniger (Ashland College, Ohio) 1974 142 p refs
(BM-RI-7952) Avail: NTIS HC $10.25

The Bureau of Mines conducted surface joint and stress measurements, airborne remote sensing imagery studies, compass-oriented borehole televiewer surveys, numerical simulation of fractured wells, and well productivity studies in a four-quadrangle study area of Ohio, to determine the effects of earth fracture systems on the deliverability of gas storage fields. The results of these studies indicate that much useful information about a gas storage reservoir can be obtained and put to practical use by studying: (1) oriented cores for fractures and directional

permeability, (2) orientation of induced hydraulic fractures for alignment of well patterns, and (3) aerial photos and multispectral scanner imagery for general surface geology comparison and to determine if some development patterns can be generated by such results. Studies should be conducted in gently folded and strongly folded sedimentary formation areas to determine if the increased knowledge of earth fracture systems under these conditions might be beneficial in gasfield and gas storage reservoir development. Author

N74-34792# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
ON THE PRODUCTION OF NITRIC OXIDE BY COSMIC RAYS IN THE MESOSPHERE AND STRATOSPHERE
Marcel Nicolet 3 Sep. 1974 43 p refs
(Grant NSF GA-33446X1)
(PSU-IRL-SCI-429; SR-429) Avail: NTIS HC $5.25

The formation was studied of nitric oxide in the atmosphere through the ionization and dissociation of molecular nitrogen by galactic cosmic rays. Previous studies indicate that one NO molecule is formed for each ion pair produced by cosmic ray ionization. It was found that the height-integrated input (day and night) to the lower stratosphere is on the order of 6 x 10 to the 7th power NO molecules/sq cm/sec in the auroral zone (geomagnetic latitude phi equal to or greater than 60 deg) during the minimum of the sunspot cycle, and 4 x 10 to the 7th power NO molecules /sq cm/sec in the subauroral belt and auroral region (phi equal to or greater than 45 deg) at the maximum of solar activity: the tropical production is less than 10 to the 7th power NO molecules/sq cm/sec above 17 km; and at the equator, the production is only 3,000,000 NO molecules /sq cm/sec. Author

N74-34793*# Pan American Univ., Edinburg, Tex.
AN EXPERIMENTAL TEST OF PLANT CANOPY REFLECTANCE MODELS ON COTTON Final Report, 1 Sep. 1973 - 31 Aug. 1974
E. W. LeMaster Oct. 1974 16 p refs
(Grant NGR-44-087-001)
(NASA-CR-140588) Avail: NTIS HC $4.00 CSCL 02C

Extensive data on the plant parameters necessary to evaluate any model are presented for a cotton crop. The variation of the bidirectional reflectance function with observer altitude, observer azimuth, and sun altitude angle is presented for a high density cotton crop having leaf index of 19. A comparison with the quantitative behavior obtained from the Suits model is accomplished in the wavelength region from 400 nm to 1050 nm. Author

N74-34794*# City Coll. of the City of New York. Inst. of Oceanography.
A NOTE ON THE ANNUAL CYCLES OF SURFACE HEAT BALANCE AND TEMPERATURE OVER A CONTINENT
Jerome Spar and Gary Crane [1974] 17 p refs
(Grant NGR-33-013-086)
(NASA-CR-140587; Contrib-36) Avail: NTIS HC $4.00 CSCL 04A

A surface heating function, defined as the ratio of the time derivative of the mean annual temperature curve to the surface heat balance, is computed from the annual temperature range and heat balance data for the North American continent. An annual cycle of the surface heat balance is then reconstructed from the surface heating function and the annual temperature curve, and an annual cycle of evaporative plus turbulent heat loss is recomputed from the annual cycles of radiation balance and surface heat balance for the continent. The implications of these results for long range weather forecasting are discussed. Author

N74-34795*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
A METHOD FOR THE MEASUREMENT AND THE STATISTICAL ANALYSIS OF ATMOSPHERIC TURBULENCE
H. W. Tieleman and S. C. Tavoularis Oct. 1974 142 p refs
(Grant NGL-47-004-67)
(NASA-CR-140586; VPI-E-74-26) Avail: NTIS HC $10.25 CSCL 04A

The instantaneous values of output voltages representing the wind velocity vector and the temperature at different elevations of the 250-foot meteorological tower located at NASA Wallops Flight Center are provided with the three dimensional split-film TSI Model 1080 anemometer system. The output voltages are sampled at a rate of one every 5 milliseconds, digitized and stored on digital magnetic tapes for a time period of approximately 40 minutes, with the use of a specially designed data acqusition system. A new calibration procedure permits the conversion of the digital voltages to the respective values of the temperature and the velocity components in a Cartesian coordinate system connected with the TSI probe with considerable accuracy. Power, cross, coincidence and quadrature spectra of the wind components and the temperature are obtained with the use of the fast Fourier transform. The cosine taper data window and ensemble and frequency smoothing techniques are used to provide smooth estimates of the spectral functions. Author

N74-34796# Texas Univ., Austin. Atmospheric Science Group.
THE ROLE OF THE ATMOSPHERIC SCIENCES IN THE TEXAS COASTAL ZONE
K. H. Jehn Aug. 1974 80 p refs
(Rept-40) Avail: NTIS HC $7.00

Meteorology and climatology are described in conjunction with geology, oceanography, hydrology, and engineering, insofar as their role in shaping the configuration of the Texas coastal zone, accounting for the climate as part of the total environment, providing the air resources, and having an impact on the management problems of the Texas coastal zone. Twenty research problem areas are outlined, with literature citations. Author

N74-34797*# Toronto Univ. (Ontario). Lash Miller Chemical Labs.
THE MOLECULAR DYNAMICS OF ATMOSPHERIC REACTION Final Report, 1 Apr. 1969 - 31 Mar. 1971
J. C. Polanyi 31 Mar. 1971 10 p refs
(Grant NGR-52-026-028)
(NASA-CR-140186) Avail: NTIS HC $4.00 CSCL 04A

Detailed information about the chemistry of the upper atmosphere took the form of quantitative data concerning the rate of reaction into specified states of product vibration, rotation and translation for exothermic reaction, as well as concerning the rate of reaction from specified states of reagent vibration, rotation and translation for endothermic reaction. The techniques used were variants on the infrared chemiluminescence method. Emphasis was placed on reactions that formed, and that removed, vibrationally-excited hydroxyl radicals. Fundamental studies were also performed on exothermic reactions involving hydrogen halides. Author

N74-34798# Joint Publications Research Service, Arlington, Va.
GEODESY AND AERIAL PHOTOGRAPHY, 1972
19 Sep. 1974 177 p refs Transl. into ENGLISH of Izv. Vyssch. Ucheb. Zaved., Geod. Aerofotos. (Moscow), no. 6, 1972 p 3-132
(JPRS-63013) Avail: NTIS HC $12.00

Development and implementation of aerial photogeodesy and related cartographic fields of specialization are considered. For individual titles, see N74-34799 through N74-34811.

N74-34799 Joint Publications Research Service, Arlington, Va.
FUNDAMENTAL ADVANCES IN GEODESY IN THE USSR
V. P. Morozov *In its* Geodesy and Aerial Phot., 1972 (JPRS-63013) 19 Sep. 1974 p 30-43 Transl. into ENGLISH from Izv. Vyssch. Ucheb. Zaved., Geod. Aerofotos. (Moscow), no. 6, 1972 p 21-30 (For availability see N74-34798 24-13)

An overview of astrogeodetic work is given that ranges from classical triangulation, light and rangefinding polygonometry, and trilateration to spheroidal geodesy and associated mathematical processing methods. G.G.

N74-34800 Joint Publications Research Service, Arlington, Va.
GEODESY AND SPACE
L. P. Pellinen *In its* Geodesy and Aerial Phot., 1972 (JPRS-63013) 19 Sep. 1974 p 44-55 refs Transl. into ENGLISH from Izv. Vyssch. Ucheb. Zaved., Geod. Aerofotos. (Moscow),

no. 6, 1972 p 31-38 (For availability see N74-34798 24-13)

Optical and radio observations of artificial satellites are utilized to obtain geodetic information of high accuracy. The former constitute photographing earth satellites against a background of stars, and laser ranging; the latter encompass Doppler measurements on satellite radial velocity as well as radar methods. G.G.

N74-34801 Joint Publications Research Service, Arlington, Va.
ROLE OF GEODETIC ENGINEERING IN THE NATIONAL ECONOMY

N. N. Lebedev *In its* Geodesy and Aerial Phot., 1972 (JPRS-63013) 19 Sep. 1974 p 56-69 Transl. into ENGLISH from Izv. Vyssch. Ucheb. Zaved., Geod. Aerofotos. (Moscow), no. 6, 1972 p 39-48 (For availability see N74-34798 24-13)

Methods and procedures of geodetic engineering are described and their impact on planning and constructaion of industrial factories, on implementing measures in forestry and agriculture, and on development of natural resources and urban settlements, are elaborated. G.G.

N74-34802 Joint Publications Research Service, Arlington, Va.
DEVELOPMENT OF GRAVIMETRY AND THE THEORY OF FIGURE OF THE EARTH

B. P. Shimbirev and P. F. Shokin *In its* Geodesy and Aerial Phot., 1972 (JPRS-63013) 19 Sep. 1974 p 70-83 refs Transl. into ENGLISH from Izv. Vyssch. Ucheb. Zaved., Geod. Aerofotos. (Moscow), no. 6, 1972 p 49-57 (For availability see N74-34798 24-13)

Detailed information concerning the structure of the earth's gravity field and its change with time is needed to solve problems in studies on: (1) circumterrestrial space; (2) precise determination of the relative position of individual points on the earth's surface; (3) the internal structure, distribution and dynamics of the earth's mass; as well as (4) in observation on satellite motions. G.G.

N74-34803 Joint Publications Research Service, Arlington, Va.
ADVANCES AND TASKS IN GEODETIC ASTRONOMY

A. N. Kuznetsov *In its* Geodesy and Aerial Phot., 1972 (JPRS-63013) 19 Sep. 1974 p 84-96 Transl. into ENGLISH from Izv. Vyssch. Ucheb. Zaved., Geod. Aerofotos. (Moscow), no. 6, 1972 p 59-67 (For availability see N74-34798 24-13)

The most important developments in geodetic astronomy are: (1) photoelectric and contact micrometric registrations of star transits; (2) accurate determination of Laplace azimuths; (3) creation of improved portable astronomical instruments; and (4) computerized processing of astronomical observations. G.G.

N74-34804 Joint Publications Research Service, Arlington, Va.
PHOTOGRAPHIC EXPERIMENTS DURING MULTIDAY SPACESHIP FLIGHT **c14**

V. I. Sevastyanov *In its* Geodesy and Aerial Phot., 1972 (JPRS-63013) 19 Sep. 1974 p 97-100 Transl. into ENGLISH from Izv. Vyssch. Ucheb. Zaved., Geod. Aerofotos. (Moscow), no. 6, 1972 p 69-71 (For availability see N74-34798 24-13)

Photographic and spectrophotometric observations aboard Soyus 9 spacecraft are outlined. The overall purpose was a study of the earth's surface and atmosphere with applications to geological prospecting, long range meteorological forecasting, and aerial surveying of land use and urban development. G.G.

N74-34805 Joint Publications Research Service, Arlington, Va.
DEVELOPMENT OF AERIAL SURVEYING **c14**

Docent N. P. Lavrova and M. D. Konshin *In its* Geodesy and Aerial Phot., 1972 (JPRS-63013) 19 Sep. 1974 p 101-113 Transl. into ENGLISH from Izv. Vyssch. Ucheb. Zaved., Geod. Aerofotos. (Moscow), no. 6, 1972 p 73-81 (For availability see N74-34798 24-13)

Aerial photographic surveying by automatic interplanetary Zond stations resulted in: (1) the development of compiling maps of the lunar surface at scales of 1:1,000,000 and 2:1:2,000,000; (2) chemical photographic processing of space photographs: (3) spectrophotometric investigations of the lunar and earth's surface; (4) creation of brightness maps for the earth and moon; (5) studies on cloud formations for weather prediction; and (6) physiographic regionalization of extensive territories. G.G.

N74-34806 Joint Publications Research Service, Arlington, Va.
PROBLEMS AND PROSPECTS IN THE DEVELOPMENT OF PHOTOGRAMMETRY **c14**

F. V. Drobyshev and A. N. Lobanov *In its* Geodesy and Aerial Phot., 1972 (JPRS-63013) 19 Sep. 1974 p 114-123 Transl. into ENGLISH from Izv. Vyssch. Ucheb. Zaved., Geod. Aerofotos. (Moscow), no. 6, 1972 p 83-89 (For availability see N74-34798 24-13)

The organization of aerial survey production in the U.S.S.R. is outlined and the principle method for compiling maps on the basis of a photographic survey by a combined method is elaborated. This differentiating operation obtains the contour part in the form of photoplans of the terrain and the vertical part in the form of contour lines on aerial photographs, sketched on topographic stereometers. Contours are transferred onto the photoplan by stereoscopes or projectors. G.G.

N74-34807 Joint Publications Research Service, Arlington, Va.
SOVIET CARTOGRAPHY, ITS ATTAINMENTS AND PATH OF DEVELOPMENT

V. I. Sukhov, A. I. Preobrazhenskiy, and N. M. Volkov *In its* Geodesy and Aerial Phot., 1972 (JPRS-63013) 19 Sep. 1974 p 124-137 Transl. into ENGLISH from Izv. Vyssch. Ucheb. Zaved., Geod. Aerofotos. (Moscow), no. 6, 1972 p 91-99 (For availability see N74-34798 24-13)

Scientific principles and practical developments of various cartographic products are briefly reported with emphasis on special mapping for physical geography. G.G.

N74-34808 Joint Publications Research Service, Arlington, Va.
WAYS TO DEVELOP GEODETIC INSTRUMENT MAKING **c14**

S. V. Yeliseyev *In its* Geodesy and Aerial Phot., 1972 (JPRS-63013) 19 Sep. 1974 p 138-150 Transl. into ENGLISH from Izv. Vyssch. Ucheb. Zaved., Geod. Aerofotos. (Moscow), no. 6, 1972 p 107-115 (For availability see N74-34798 24-13)

Design, development, and production are discussed for highly precise optical theodolites, leveling instruments, pulsed light and radio range finders, and automated angle measuring devices. G.G.

N74-34809 Joint Publications Research Service, Arlington, Va.
OPTICS IN GEODESY AND PHOTOGRAMMETRY **c14**

N. P. Zakaznov *In its* Geodesy and Aerial Phot., 1972 (JPRS-63013) 19 Sep. 1974 p 151-156 refs Transl. into ENGLISH from Izv. Vyssch. Ucheb. Zaved., Geod. Aerofotos. (Moscow), no. 6, 1972 p 117-120 (For availability see N74-34798 24-13)

Different optical systems are used in geodetic and photogrammetric instruments. These include telescopic systems, microscopes, photographic objectives, projection and lighting systems. The modern status of geodetic and photogrammetric instrument making is characterized by use of different radiation detectors (photoemulsion layers, photocathodes of photoelements (photocells) and photomultipliers, television tubes and image converters, etc.) acting in the range of wavelengths exceeding the limits of the visible part of the spectrum. In addition, the radiation of lasers is employed jointly with collimating and focusing optical systems. Author

N74-34810 Joint Publications Research Service, Arlington, Va.
OPTICAL-ELECTRONIC INSTRUMENTS IN GEODESY **c14**

Yu. G. Yakushenkov *In its* Geodesy and Aerial Phot., 1972 (JPRS-63013) 19 Sep. 1974 p 157-167 refs Transl. into ENGLISH from Izv. Vyssch. Ucheb. Zaved., Geod. Aerofotos. (Moscow), no. 6, 1972 p 121-127 (For availability see N74-34798 24-13)

Operating principles, design methods, and geodetic applications of laser devices are described, and the use of optical electronic instruments for automatic processing of optical information is developed. G.G.

N74-34811 Joint Publications Research Service, Arlington, Va.
WORK OF THE SPECIALIZED SCIENTIFIC CONFERENCE SPACE SURVEYS FOR STUDYING THE EARTH AND PLANETS **c30**

V. L. Zaychenko *In its* Geodesy and Aerial Phot., 1972

(JPRS-63013) 19 Sep. 1974 p 168-173 Transl. into ENGLISH from Izv. Vyssch. Ucheb. Zaved., Geod. Aerofotos. (Moscow), no. 6, 1972 p 129-132 (For availability see N74-34798 24-13)

Photometric analyses on photographs of the earth- and lunar-surfaces taken by satellites are elaborated for processing into cartographic maps. G.G.

N74-34812*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

STATISTICAL SUMMARY OF AIR QUALITY DATA FOR METROPOLITAN CLEVELAND, OHIO, 1967 - 1972: TOTAL SUSPENDED PARTICULATES, NITROGEN DIOXIDE, AND SULFUR DIOXIDE

Robert B. King, Harold E. Neustadter, J. Stuart Fordyce, John C. Burr, Jr. (Ohio Environ. Protection Agency), and C. Lawrence Cornett (Cleveland Air Pollution Control Div.) Washington NASA Oct. 1974 36 p refs

(NASA-TM-X-3113; E-7850) Avail: NTIS HC $3.25 CSCL 13B

Air-quality data for metropolitan Cleveland, Ohio, from 1967 through 1972 were collated and statistically analyzed. Total suspended particulates (TSP) departed from lognormal distribution in 1972. Nitrogen dioxide and sulfur dioxide, departed significantly from lognormal distributions in 1972. In Cleveland the Ohio standards were not met. However, the data indicate a general improvement in air quality. Unusually high precipitation (43% above the average in 1972) may be responsible in lowering these values from the 1971 levels. The mean values of TSP, NO2, and SO2 are 104, 191, and 83 microgram/cu m respectively. Author

N74-34813*# Applied Science Associates, Inc., Apex, N.C.

GULF STREAM MODEL Final Report

Sep. 1974 156 p refs

(Contract NAS6-2307)

(NASA-CR-137471) Avail: NTIS HC $11.00 CSCL 08C

Surface elevation deviations in the Gulf Stream region off the eastern coast of the United States between Wallops Island, Virginia and Miami, Florida were investigated. The main causes of surface elevation deviations are geoid perturbations due to the continental shelf and the geostrophic adjustment of the density field due to the Gulf Stream. Quantitative surface elevation profiles were calculated based on geophysical measurements of gravity anomalies and hydrographic data. The results are presented graphically along with contemporaneous weather data. Comparisons are made between the profiles based on hydrographic data and a mean theoretical model. The theory of geostrophic flows including some classical Gulf Stream models is also presented briefly. Author

N74-34814*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.

A SYSTEM TO GEOMETRICALLY RECTIFY AND MAP AIRBORNE SCANNER IMAGERY AND TO ESTIMATE GROUND AREA Technical Report, 1 Feb. 1973 - 31 Jan. 1974

M. M. Spencer, J. M. Wolf, and M. A. Schall Washington NASA Oct. 1974 46 p refs

(Contract NAS9-9784)

(NASA-CR-2460; ERIM-190100-28-T) Avail: NTIS HC $3.25 CSCL 08B

A system of computer programs were developed which performs geometric rectification and line-by-line mapping of airborne multispectral scanner data to ground coordinates and estimates ground area. The system requires aircraft attitude and positional information furnished by ancillary aircraft equipment, as well as ground control points. The geometric correction and mapping procedure locates the scan lines, or the pixels on each line, in terms of map grid coordinates. The area estimation procedure gives ground area for each pixel or for a predesignated parcel specified in map grid coordinates. The results of exercising the system with simulated data showed the uncorrected video and corrected imagery and produced area estimates accurate to better than 99.7%. Author

N74-34815# Helsinki Univ. of Technology, Otaniemi (Finland). Radio Lab.

EXPERIMENTS ON REMOTE SENSING OF SEA ICE USING A MICROWAVE RADIOMETER

Martti Tiuri 1974 12 p refs

(S-67; ISBN-951-750-329-6) Avail: NTIS HC $4.00

Investigations were carried out in Finland to determine whether microwave radiometers are useful for surveying sea ice for the purpose of guiding ice breakers in the Baltic Sea. The frequency of the radiometer was set at 4.7 GHz. The three-channel radiometer used a novel traveling wave antenna with a beam direction dependent on the frequency, and was carried by a helicopter to measure the brightness temperatures of three adjacent ice strips. An auxiliary radiometer was used at 605 MHz for checking purposes. The results of measurements made during the winter of 1974 are discussed. Author

N74-34816# Environmental Data Service, Washington, D.C. Center for Experimental Design and Data Analysis.

PROFITS IN THE LOWEST 300 METERS OF THE MARINE TROPICAL PLANETARY BOUNDARY LAYER

C. F. Ropelewski Sep. 1974 27 p refs

(NOAA-TM-EDS-BOMAP-12) Avail: NTIS HC $4.50

Profiles are presented of virtual temperature, potential temperature, specific humidity, and windspeed, based on data gathered with the Boundary Layer Instrument Package (BLIP) during the Barbados Oceanographic and Meteorological Experiment (BOMEX) in 1969. Included are mean profiles of these parameters for undisturbed conditions and several sets of profiles for disturbed conditions. Author

N74-34817*# Ambionics, Inc., Washington, D.C.

REMOTE SENSING OF COAL MINE POLLUTION IN THE UPPER POTOMAC RIVER BASIN Final Report

[1974] 70 p refs Sponsored in part by EPA

(Contract NAS1-12673)

(NASA-CR-132529) Avail: NTIS HC $6.50 CSCL 08H

A survey of remote sensing data pertinent to locating and monitoring sources of pollution resulting from surface and shaft mining operations was conducted in order to determine the various methods by which ERTS and aircraft remote sensing data can be used as a replacement for, or a supplement to traditional methods of monitoring coal mine pollution of the upper Potomac Basin. The gathering and analysis of representative samples of the raw and processed data obtained during the survey are described, along with plans to demonstrate and optimize the data collection processes. Author

N74-34818# Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.

AREAL SNOW COVER OBSERVATIONS IN THE CENTRAL ROCKIES, COLORADO

Arden D. Haeffner and Charles F. Leaf Nov. 1973 20 p refs Sponsored in part by Dept. of Interior

(RM-5) Avail: NTIS HC $4.00

Photographic records of areal snow cover depletion during the 1964-71 snowmelt seasons in the Fraser Experimental Forest, and in the Park Range from 1966-71, are summarized. Included are detailed estimates of snow cover extent on more than 90 hydrologic subunits which comprise the six watersheds photographed. Applications of these data in streamflow forecasting, water balance analyses, and snow cover duration are suggested. Author

N74-34819# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.

IONOSPHERIC DATA

Asheville, N. C. Natl. Climatic Center Aug. 1973 131 p

(FA-360) Avail: NTIS MF $2.25; National Climate Center, Federal Building, Asheville, N. C. 28801. Attn: Publications HC $1.00

The publication now contains monthly medians only for the same month the publication is issued. These data are from the worldwide network of observatory ionospheric vertical sounding stations as reported to World Data Center A for Solar-Terrestrial Physics, Boulder, Colorado 80302, U.S.A. These data describe the climatology of the ionosphere as measured by ionosondes. Data tables give the monthly median and other statistics for each hour of the day for the principal characteristics derived from ionograms. Author

N74-34820# Technische Universitaet, Brunswick (West Germany). Inst. fuer Geophysik und Meteorologie.
GEOSCIENTIFIC ASPECTS OF SUPPLYING ENERGY [GEOWISSENSCHAFTLICHE ASPEKTE ZUR ENERGIEVERSORGUNG]
Walter Kertz 1974 23 p refs In GERMAN Presented at 34th Jahresversammlung der Deut. Geophysik. Ges., Berlin, 26 Mar. 1974 *Its* GAMMA 26, 18 S., 1974
Avail: NTIS HC $4.25

Geoscientific aspects of energy sources consider future energy demands on nuclear fission, controlled nuclear fusion, solar energy, and geothermal energy. The danger of violating the entropy law through heating of the atmosphere by spend energy is discussed. Transl. by G.G.

N74-34821*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AERODYNAMIC SIZE DISTRIBUTION OF SUSPENDED PARTICULATE MATTER IN THE AMBIENT AIR IN THE CITY OF CLEVELAND, OHIO
Harold F. Leibecki, Robert B. King, and J. Stuart Fordyce Washington Oct. 1974 17 p refs
(NASA-TM-X-3124; E-8024) Avail: NTIS HC $3.00 CSCL 04A

The City of Cleveland Division of Air Pollution Control and NASA jointly investigated the chemical and physical characteristics of the suspended particulate matter in Cleveland, and as part of the program, measurements of the particle size distribution of ambient air samples at five urban locations during August and September 1972 were made using high-volume cascade impactions. The distributions were evaluated for lognormality, and the mass median diameters were compared between locations and as a function of resultant wind direction. Junge-type distributions were consistent with dirty continental aerosols. About two-thirds of the suspended particulate matter observed in Cleveland is less than 7 microns in diameter. Author

N74-34822# Illinois Univ., Urbana. Aeronomy Lab.
AN INVESTIGATION OF ODD NITROGEN IN THE IONOSPHERIC E REGION
N. Golshan and C. F. Sechrist, Jr. 1 Sep. 1974 214 p refs (Grant NSF GA-36911X)
(UILU-ENG-74-2504; Aeronomy-61) Avail: NTIS HC $13.75

Measured electron density and (NO(+))/(O2(+)) data are imposed as constraints on an appropriate model of E-region natural and ion chemistry including the effects of transport and time variations. The ion composition constraint implies a strong dependence of (NO) on soft X-rays leading to the conclusion that dissociation of N2 by energetic photoelectrons is a major source of N(2D). Seasonal variations of the thermosphere cause enhanced (NO) in summer in agreement with the summer enhancement of experimental (NO(+))/(O2(+)). Variations of (N(2S)), (N(2D)) and (NO) with altitude, solar zenith angle, season and solar activity are determined theroetically. The (N(4S))/(NO) ratio is very sensitive to the absorbed soft X-ray flux and thermospheric composition and temperature. The diurnal variations of (N(4S)) and (NO) depend strongly on the (N(4S))/(NO) ratio in the afternoon. Author

N74-34823# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA, NO. 360. PART 1: (PROMPT REPORTS), DATA FOR JULY AND JUNE 1974
Hope I. Leighton, ed. Aug. 1974 136 p
Avail: NTIS MF $2.25; National Climatic Center, Federal Building, Asheville, N. C. 28801. Attn: Publications HC $1.25

Predicted and observed solar and geophysical data for June and July 1974 are presented in tables and graphs. The data include sunspot numbers, solar flux, solar flares and their effects, magnetic storms, and SID effects. Author

N74-34824# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA, NO. 360. PART 2: (COMPREHENSIVE REPORTS), DATA FOR FEBRUARY 1974, JANUARY 1974, AND MISCELLANEA
Hope I. Leighton, ed. Aug. 1974 38 p
Avail: NTIS MF $2.25; National Climate Center, Federal Building, Asheville, N. C. 28801. Attn: Publications HC $1.25

Observational data are listed for solar flares, solar radio waves, solar X-ray radiation, solar proton monitoring, and for magnetograms of geomagnetic storms. G.G.

N74-34825# Northeastern Univ., Boston, Mass. Dept. of Physics.
ON THE GAUGE INVARIANCE OF GRAVITATIONAL THEORY
Marvin H. Friedman Oct. 1974 7 p refs
(NUB-2239) Avail: NTIS HC $4.00

Einstein's theory of gravitation is gauge invariant under SL(2,C) and GL(4,R). The latter invariance and the recently proposed modification of Einstein's equations by Yang are discussed. Author

N74-34826# Elliott-Automation Space and Advanced Military Systems, Ltd., Camberley (England).
SIDE-LOOKING RADAR SYSTEMS AND THEIR POTENTIAL APPLICATION TO EARTH-RESOURCES SURVEYS: SUMMARY VOLUME
K. Grant et al Paris ESRO Mar. 1973 151 p
(Contract ESTEC-1537/71)
(ESRO-CR-141) Avail: NTIS HC $10.75

The results of a 9-month study on side looking radar (SLR) systems and their potential application to earth resources surveys are summarized. Information is provided on the basic physics and technology of SLR, radar scattering from natural surfaces, potential applications in the earth sciences, and the processing of SLR data. From this background, recommendations are provided on a European program for the development, evaluation, and application of SLR, considering both aircraft and satellite platforms. Author (ESRO)

N74-34827# Geodynamics Committee, Washington, D.C.
US PROGRAM FOR THE GEODYNAMICS PROJECT: SCOPE AND OBJECTIVES
Nov. 1973 238 p
(PB-232662/7; ISBN-0-309-02211-8) Avail: NTIS MF $2.25; National Academy of Sciences, Printing and Publishing Office, 2101 Constitution Ave., Washington, D. C. 20418 HC $3.25 CSCL 08G

The Geodynamics Project spanning the year 1971-1979 is an international program and intensive effort to study the basic mechanism of earth deformation. Now the report is available for the benefit of all those involved in geoscience at any level. It sets forth the background of the program, states why geodynamics studies are timely, reviews the objectives of the U.S. program, describes the scientific scope of geodynamics problems, and suggests the kinds of research that should be pursued toward solution of these problems. The focus of the proposed U.S. Program is on the plate-tectonics model because its ability to explain and predict appears to be greater than any previous or alternative model. GRA

N74-34828# Dallas Seismological Observatory, Tex.
RESEARCH IN ATMOSPHERIC ACOUSTICS Final Report, 5 Mar. 1971 - 31 Dec. 1973
Eugene Herrin and John A. McDonald 31 Jan. 1974 33 p refs
(Contract F44620-71-C-0073; AF Proj. 9751)
(AD-782062; AFOSR-74-1140TR) Avail: NTIS CSCL 04/1

The report is a review of research in atmospheric acoustics at the Dallas Seismological Observatory over a period of about 34 months. The experimental work can be roughly divided in three phases. First involved the building of arrays of microbarographs and anemometers, and the collecting of data from these instruments in digital formats. Secondly, a suite of software programs were developed to process the data from these arrays (and also data in similar format from Alaska and from England). These programs ranged from simple editing routines to sophisticated array processing techniques which advanced the state-of-the-art. And, lastly, the processed data were used in interpretations of various atmospheric processes. These ranged from subsonic wind associated phenomena to waves propagating at acoustic velocities which were due to atmospheric explosions. (Modified author abstract) GRA

N74-34829# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROBLEMS OF PHYSICS OF THE ATMOSPHERE
I. S. Ivlev 14 Jun. 1974 17 p refs Transl. into ENGLISH from Probl. Fiz. Atm. (USSR), no. 10, 1972 p 92-103
(AD-782531; FTD-HC-23-1639-74) Avail: NTIS CSCL 04/2

The report discusses aerosols in the atmosphere, balloon sampling carried out from 1964 to 1969 in the U.S.S.R., and particle size distributions as a function of altitude. GRA

N74-34830# Keuffel and Esser Co., Morristown, N.J.
DIGITAL MAPPING SYSTEM: MATHEMATICAL PROCESSING Final Report, 7 Apr. 1972 - 31 May 1974
Paul Rosenberg, Kent E. Erickson, and Gerhardt Rowe, C. May 1974 138 p Prepared in cooperation with Rosenberg (Paul) Associates, Pelham, N. Y.
(Contract DAAK02-72-C-0288)
(AD-782230; ETL-CR-74-6) Avail: NTIS CSCL 08/2

Principal and critical parts of the mathematical processing in the Digital Mapping System (DMS) have been formulated, developed, tested and evaluated, using actual digitized density data from aerial photographs. The results indicate that the DMS, including the infiltration procedure and mixed coordinates, is feasible. Automatic matching and infiltration have been demonstrated successfully in a variety of scenes. Recommendations are made for further development of the DMS. The DMS is an automatic system for producing contoured topographic maps, profiles, and orthophotographs accurately from aerial photographs, by digital methods only. GRA

N74-34831# Kansas Univ. Center for Research, Inc., Lawrence.
SCATTEROMETRY TECHNIQUES FOR SENSING ARTIC SEA ICE THICKNESS Final Report
Albert W. Biggs, D. L. Fayman, R. Matreci, R. K. Moore, and S. K. Parashar Nov. 1973 348 p refs
(Contract N60921-70-C-0221)
(AD-782611; CRES-TR-185-12; CRES-TR-185-13) Avail: NTIS CSCL 08/12

Investigation of radar discrimination of sea ice is presented. Radar scatterometer data at 75 and 2.25 cm wavelength obtained from NASA Earth Resources Aircraft Program Mission 126 were analyzed. The mission was conducted in April, 1970, off the coast of Point Barrow, Alaska. The scatterometer data were separated into seven different categories of sea ice. Sea ice was categorized according to thickness and age. The radar scattering from sea ice is compared for different sea ice types. An analytical theory of scatter from sea ice was developed and is presented. (Modified author abstract) GRA

N74-34832# Florida State Univ., Tallahassee. Dept. of Oceanography.
WIND INDUCED CURRENTS AND SEA SURFACE SLOPES IN THE EASTERN GULF OF MEXICO
John Cragg and Wilton Sturges Jun. 1974 58 p refs
(Contract N00014-67-A-0235-0002; Grant NSF GA-29734; NR Proj. 083-231)
(AD-782650) Avail: NTIS CSCL 08/3

Meteorological and tidal records at three Florida Gulf coast stations have been examined for the period 1965-67. Cross spectral analysis of daily winds and sea levels showed a high coherence at periods of 4 to 20 days. Daily sea levels have been correlated with winds of varying directions and speeds with good results. Sea level was found to be most responsive to winds that were within about 10 degrees of parallel to the direction of the coastline. A longshore wind of 4.5 m/sec caused a sea level fluctuation of 20 cm. Onshore-offshore winds did not produce sea level fluctuations that were discernible above the noise level. Wind components at weather stations separated by up to 300 km were found to have coherence above 0.6 for the periods of 4 to 100 days. (Modified author abstract) GRA

N74-34833# Israel Program for Scientific Translations, Ltd., Jerusalem.
ACTINOMETRY ATMOSPHERIC OPTICS OZONOMETRY
G. P. Gushchin, ed. 1974 206 p refs Transl. into ENGLISH of the book "Aktinometriya, Atmosfernaya Optika, Ozonometriya" Leningrad, Gidrometeoizdat, 1972 206 p Sponsored by the US-Israel Binatl. Sci. Found.
(TT-74-50009) Avail: NTIS HC $5.75 CSCL 04A

Discrepancies between daily sums of total radiation measurement and recorders at different stations are reported and the seasonal distribution of these discrepancies. The probability of obtaining an error greater than 10% in the measurement of the daily sum of total radiation is assessed. The shortcomings of the instrument encountered in the network of actionmetric stations are enumerated. GRA

N74-34834# Geological Survey, Menlo Park, Calif.
FLASHING FLOW IN HOT WATER GEOTHERMAL WELLS: COMPUTER PROGRAM
Manuel Nathenson May 1974 34 p refs
(PB-233123/9; USGS-GD-74-021) Avail: NTIS HC$4.75 CSCL 08H

A PL/1 computer program for calculating the production characteristics of hot water geothermal wells which flash to steam-water mixtures in the cased portion of the hole is presented. The flashing flow is assumed to be isenthalpic and, for purposes of calculating pressure drop, a finely dispersed mixture of equal average velocity. The flow in the aquifer is treated using steady radial Darcy flow. The thermodynamic properties of saturated water and steam are obtained using interpolation and a stored set of steam tables. GRA

N74-34835# Woods Hole Oceanographic Institution, Mass.
A COMPILATION OF MOORED WIND AND CURRENT OBSERVATIONS TAKEN IN 1967
Susan Tarbell Jan. 1974 139 p refs
(Contract N00014-66-C-0241; NR Proj. 083-004)
(AD-782366; WHOI-74-4) Avail: NTIS CSCL 08/3

Summaries of wind and current measurements made with current meters and wind recorders by the Woods Hole Oceanographic Institution during the year 1967 are presented. Averaged quantities are presented in computer-generated output as histograms, basic statistics, spectra, progressive vector diagrams, and east-north component plots. Author (GRA)

N74-34836# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
PARTIAL SOLAR ECLIPSE EFFECTS ON TEMPERATURE AND WIND IN AN EQUATORIAL ATMOSPHERE Research and Development Report
J. S. Randhawa Jun. 1974 15 p refs
(DA Proj. 1T0-61102-B-53A)
(AD-782956; ECOM-5544) Avail: NTIS CSCL 04/1

A partial solar eclipse (approximately three hours duration) occurred at Fort Sherman, Panama Canal Zone (9 deg 20 min N, 79 deg 59 min W), in the early morning hours on 24 December 1973. Five rocket-borne temperature sensors were deployed at an altitude of 60 to 65 km before, during, and after the eclipse. Temperatures and winds were measured as the sensors descended by parachute. Analysis of the data indicates that there was 3- to 5C cooling produced in the layer 50-52 km as the solar radiation was partially blocked from reaching the earth's atmosphere. Zonal wind speed was also affected at those levels from 15 m/sec before the eclipse to 9 m/sec during the maximum phase. Author (GRA)

N74-34837# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
DIFFERENTIAL PHASE VOLUME MODEL AND AMPLITUDE MEASUREMENTS OF PARTIAL REFLECTIONS
David B. Newman, Jr. 21 Jun. 1974 194 p refs
(Contract N00014-67-A-0385-0014; Grant NSF GA-13885)
(AD-782921; PSU-IRL-SCI-426) Avail: NTIS CSCL 04/1

The work presents a theoretical model of the differential phase experiment which accounts for scattering from a volume of irregularities. The expected value of the phase difference angle between ordinary and extraordinary mode partially reflected radio waves is derived and computer simulated data from several electron number density profiles are presented. The effect of the transmitter pulse length is clearly indicated and limitations of the theory in terms of probing frequency are discussed. An extensive effort was undertaken to investigate the nature of scattering of signals from the D-region. Numerous recordings of amplitude data were made, and the resulting data analysis shows that the amplitudes of partially reflected echoes obey a

Rayleigh probability density function. This finding strongly supports the volume theory of this work. The study of amplitude data also shows that the D-region is generally quasi-static over a time period of 150 milliseconds during noon time and quiet ionospheric conditions. With this finding it is suggested that for a successful differential phase experiment and an improved differential absorption experiment a set of ordinary and extraordinary mode transmitted pulses should be transmitted within this time period. Author (GRA)

N74-34838# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A METHOD FOR DETERMINING THE CONCENTRATION OF CHARGED AIR PARTICLES
U. A. Bragin 24 Jun. 1974 13 p refs Transl. into ENGLISH from Tr. Tsent. Aerol. Observ. (Moscow), no. 46, 1963 p 96-100
(AD-783450; FTD-HT-23-1574-74) Avail: NTIS CSCL 04/1

The authors examined the question concerning the effect of the intrinsic charge of a flying body on the distribution of charged particles at the entrance to the instrument in dense gas. They present the estimations of the effect of the ultraviolet radiation on the readings of the instrument and gasdynamic relationships which connect the concentration values determined in the instrument chamber with the corresponding values in an unperturbed atmosphere. GRA

N74-34839# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
GOOSE BAY RIOMETER OBSERVATIONS Instrumentation Papers
Raymond J. Cormier 19 Feb. 1974 27 p refs
(AF Proj. 5631)
(AD-783243; AFCRL-IP-214; AFCRL-TR-74-0097) Avail: NTIS CSCL 04/1

At Goose Bay, Labrador, 30-MHz riometers using a four-corner reflector antenna have been in operation since November 1971. An 18-MHz riometer using a zenith-pointing antenna has been operational since June 1972. A quiet day curve of 30 MHz has been constructed for the Goose Bay 30 MHz, and useful hours of operation for an 18-MHz riometer at this particular site are discussed. The usefulness of the four-corner reflector antenna over a single zenith-pointing antenna is discussed, in particular, in an auroral environment. Examples of data illustrating the performance of the antenna system are presented. The data selected are for the geomagnetically active period of mid-April to early May 1973. Author (GRA)

N74-34840# Washington Univ., Seattle. Arctic Ice Dynamics Joint Experiment Office.
OCEANIC AND ATMOSPHERIC BOUNDARY LAYER STUDY Technical Report, 1 Nov. 1973 - 30 Apr. 1974
M. D. Coon 30 Apr. 1974 49 p refs
(Contract F44620-74-C-0013; ARPA Order 2591)
(AD-782091; AFOSR-74-1132TR) Avail: NTIS CSCL 08/12

The AIDJEX Modeling Group is developing a predictive model of the dynamics and thermodynamics of the arctic ice cover. To date, an elastic-plastic model of the ice behavior has been developed and operated using field data from AIDJEX pilot programs. A complete model using air stress, water stress, and momentum balance for the ice pack will be developed by the spring of 1975 and checked against the AIDJEX field data taken in a year-long experiment from spring 1975 to spring 1976. Author (GRA)

N74-34841# Keuffel and Esser Co., Morristown, N.J.
DIGITAL MAPPING GLOSSARY
Paul Rosenberg, Kent Erickson, and Gerhardt C. Rowe Jan. 1974 62 p refs
(Contract DAAK02-72-C-0288)
(AD-782328; ETL-CR-74-13) Avail: NTIS CSCL 08/2

A glossary has been compiled primarily for the benefit of photogrammetrists and computer scientists engaged in the development and use of semi-automatic and automatic digital mapping systems. Terms in the following categories are defined: (a) Terms with meanings in digital mapping that are different from the meanings of these terms in conventional non-digital photogrammetry; (b) Terms with meanings in digital mapping that are different from the usual meanings of these terms in related disciplines, e.g. in mathematics, computer science, engineering, physics, optics, electronics, and information display; (c) A limited number of terms, unfamiliar to photogrammetrists, that are used in digital mapping with the same meanings as in the aforesaid disciplines; and, (d) Special terms of the Digital Mapping System (DMS). GRA

N74-34842# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
THE MACHINE REDUCTION OF IONOGRAMS, TESTING OF AND IMPROVEMENTS TO THE PROCESS
Paul E. Bennett 31 May 1974 80 p refs
(Contract N00014-67-A-0385-0017)
(AD-782924; PSU-IRL-SCI-427) Avail: NTIS CSCL 04/1

The sources of error in a machine recuction program for ionogram data were evaluated. The major source of error was found to be the tracing of the returns. The magnitudes of the errors were found to be small in comparison with those expected in the input data. A pattern recognition technique was developed to aid in the computer identification of traces on the ionogram tracings. Test results indicated that significant increases in useable data could be gained by the use of this technique. Several programs for the calculation of electron density were tested. General accuracy, underlying ionization corrections, peak extrapolatin and the times required for computation were tested. (Modified author abstract) GRA

N74-34843# Aerospace Corp., El Segundo, Calif. Lab. Operations.
EXCITATION OF INFRARED AURORAL EMISSIONS IN COLLISIONS OF HT AND H WITH N2 Interim Report
John H. Birely and Peter A. Johnson 5 Jul. 1974 11 p refs
(Contract F04701-74-C-0075)
(AD-783211; TR-0075(9270-01)-2; SAMSO-TR-74-157) Avail: NTIS CSCL 04A

Cross sections for emission of the (N2(+)(A doublet Pi(u) - X doublet Sigma (g)(+)) Meinel (2,0) and the (N2(B triplet Pi(g) - A triplet Sigma (u)(+)) first positive (1P) (3,1) bands in 0.5 to 25 keV H(+) and H impact on N2 are reported. It is shown that, in a hydrogen aurora, H(+) and H impact make comparable contributions to the Meinel band intensity, but that neutral hydrogen impact is the predominant source of 1P emission. The vibrational distribution of N2(+) formed in 25 keV H(+) and H impact with v; = 2-5 is shown to be in good agreement with the prediction of a simple, Franck-Condon model. (Modified author abstract) GRA

N74-34844# Scripps Institution of Oceanography, La Jolla, Calif. Advanced Ocean Engineering Lab.
ADVANCED MARINE TECHNOLOGY: ELECTROMAGNETIC ROUGHNESS OF THE OCEAN SURFACE, 2-30 MHz Final Report, 15 Dec. 1970 - 31 Oct. 1973
Robert H. Stewart 1 May 1974 107 p refs
(Contract N00014-69-A-0200-6012; NR Proj. 294-016)
(AD-783189; AOEL-61; SIO-Ref-74-13) Avail: NTIS CSCL 08/3

The report is on a three-year project entitled Electromagnetic Roughness of the Ocean Surface, 2-30 MHz. The work was concerned with using HF radio waves scattered from the sea surface primarily as a tool to measure the directional distribution of ocean wave energy. Other areas investigated were the breakdown of linear scattering theory at the high end of the HF radio band, and the use of scatter as a method to measure ocean currents remotely. (Modified author abstract) GRA

N74-34845# Scripps Institution of Oceanography, San Diego, Calif. Visibility Lab.
OCEAN COLOR ANALYSIS Final Technical Report
Siebert G. Duntley, Roswell W. Austin, Wayne H. Wilson, Catherine F. Edgerton, and Steven E. Moran Apr. 1974 72 p refs
(Contract N00014-69-A-0200-6033; Grant NOAA-04-3-158-64)
(AD-783101; SIO-Ref-74-10) Avail: NTIS CSCL 08/10

The apparent spectral signal available to a remote sensor flying over ocean waters is studied. Report considers the effect of solar zenith angle, atmospheric conditions, windspeed, spectral region, and direction of view on the sensitivity to small changes

in chlorophyll concentration. A method of synthesizing the inherent spectral radiance signature of the ocean surface is developed and new measurements of the downwelling spectral irradiance at the ocean surface and the radiance of the zenith sky are presented. Also studied are reflectance characteristics of the ocean surface when wind-generated whitecaps, foam, and spray are present. GRA

N74-34846# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PARAMETRIZATION OF CALCULATING NON-ADIABATIC FACTORS IN THE SPECTRAL PREDICTION MODEL
E. D. Blinkova 5 Jul. 1974 24 p refs Transl. into ENGLISH from Tr. Gidrometeorol. Nauch-issled. Tsentr. SSSR (USSR), no. 100, 1972 p 17-34
(AD-783580; FTD-HC-23-2099-74) Avail: NTIS CSCL 04/2

Non-adiabatic factors, related to radiative heat transfer, phase transitions of water and turbulent mixing, have an appreciable effect on the development and maintenance of atmospheric motion. A rather simple method of parametrization of non-adiabatic factors, undertaken on the basis of the spectral prediction model, is outlined in the investigation. GRA

N74-34847# Photometrics, Inc., Lexington, Mass.
ANALYSES OF CHEMICAL AND SMOKE RELEASES IN THE ATMOSPHERE Final Report, 1 Feb. 1971 - 31 Dec. 1973
Irving L. Kofsky, Christian A. Trowbridge, and Ronald H. Johnson 31 Jan. 1974 78 p refs
(Contract F19628-71-C-0018; AF Proj. 7635)
(AD-783909; PHM-104-74; AFCRL-TR-74-0102) Avail: NTIS CSCL 04/1

A program of analysis of photographic and other optical data on chemical and smoke tracers in the upper atmosphere and stratosphere, whose objective is to study winds, diffusive and turbulent transport, composition, and chemical reaction processes, is described. Images of the released materials were reduced by microdensitometry, and the films, cameras, and secondary radiance standards were photometrically calibrated. Improved techniques for scanning and Fourier transform analysis of photographically-recorded radiance distributions were developed, and contributions made to the design of systems for daytime imaging and interactive processing of pictorial data.
Author (GRA)

N74-34848# Lamont-Doherty Geological Observatory, Palisades, N.Y.
UNDERWAY MARINE GEOPHYSICAL DATA IN THE NORTH ATLANTIC, JUNE 1961 - JANUARY 1971. PART A: NAVIGATION AND GENERAL INFORMATION
Manik Talwani, Barbara Poppe, Joan Hastings, and Thomas Aitken Apr. 1974 407 p
(Contract N00014-67-A-0108-0004; Grant NSF GA-27281; NR Proj. 083-142)
(AD-782521; TR-9-Pt-A; TR-3-Pt-A) Avail: NTIS CSCL 08/7

The six-part report describes the underway marine geophysical data acquired by the Lamont-Doherty Geological Observatory during the period 1961-1971 in the North Atlantic aboard the research vessels VEMA and ROBERT D. CONRAD. The study of the data that were acquired played a basic role in the development of the theories of sea floor spreading, of plate tectonics, and of sediment accumulation and transport which have revolutionized geological thinking. This report presents the data obtained along about 350,000 n. miles of track. GRA

N74-34849# Lamont-Doherty Geological Observatory, Palisades, N.Y.
UNDERWAY MARINE GEOPHYSICAL DATA IN THE NORTH ATLANTIC, JUNE 1961 - JANUARY 1971. PART B: NAVIGATION CHARTS
Apr. 1974 74 p
(Contract N00014-67-A-0108-0004; Grant NSF GA-27281; NR Proj. 083-142)
(AD-782522; TR-9-Pt-B; TR-3-Pt-B) Avail: NTIS CSCL 08/7

Track charts for Lamont-Doherty Geological Observatory underway magnetic, gravity and depth data in the North Atlantic June 1961 - January 1971 are given including the Norwegian Sea, Gulf of Mexico, Caribbean and Mediterranean Sea.
Author (GRA)

N74-34850# Lamont-Doherty Geological Observatory, Palisades, N.Y.
UNDERWAY MARINE GEOPHYSICAL DATA IN THE NORTH ATLANTIC, JUNE 1961 - JANUARY 1971. PART C: BATHYMETRIC, GEOMAGNETIC, AND GRAVITY PROFILES
Manik Talwani, Dennis Hayes, Walter Pittman, and Thomas Aitken Apr. 1974 269 p refs
(Contract N00014-67-A-0108-0004; Grant NSF GA-27281; NR Proj. 083-142)
(AD-782523; TR-9-Pt-C; TR-3-Pt-C) Avail: NTIS CSCL 08/7

The geophysical data profiles of the underway data are displayed in computer plots. In addition, these plots indicate ship's position, speed, course, cruise station numbers, etc. All data are plotted against distance in nautical miles along track.
Author

N74-34851# Lamont-Doherty Geological Observatory, Palisades, N.Y.
UNDERWAY MARINE GEOPHYSICAL DATA IN THE NORTH ATLANTIC, JUNE 1961 - JANUARY 1971. PART D: BATHYMETRIC, GEOMAGNETIC, AND GRAVITY PROFILES
Manik Talwani, Dennis Hayes, Walter Pittman, and Thomas Aitken Apr. 1974 251 p refs
(Contract N00014-67-A-0108-0004; Grant NSF GA-27281; NR Proj. 083-142)
(AD-782524; TR-9-Pt-D; TR-3-Pt-D) Avail: NTIS CSCL 08/7

The geophysical data profiles of the underway data are displayed in computer plots. In addition, these plots indicate ship's position, speed, course, cruise station numbers, etc. All data are plotted against distance in nautical miles along track.
GRA

N74-34852# Lamont-Doherty Geological Observatory, Palisades, N.Y.
UNDERWAY MARINE GEOPHYSICAL DATA IN THE NORTH ATLANTIC, JUNE 1961 - JANUARY 1971. PART F: SEISMIC REFLECTION PROFILES
John Ewing, Maurice Ewing, Charles Windisch, and Thomas Aitken Apr. 1974 296 p refs
(Contract N00014-67-A-0108-0004; Grant NSF GA-27281; NR Proj. 083-142)
(AD-782526; TR-9-Pt-F; TR-3-Pt-F) Avail: NTIS CSCL 08/7

The six-part report describes the underway marine geophysical data acquired by the Lamont-Doherty Geological Observatory during the period 1961-1971 in the North Atlantic aboard the Research Vessels VEMA and ROBERT D. CONRAD. The report presents the data obtained by the seismic reflection profiler along about 350,000 n. miles of track. GRA

N74-34853# Naval Postgraduate School, Monterey, Calif.
SPECTRUM ANALYSIS OF TROPICAL WAVES IN THE INDIAN OCEAN M.S. Thesis
Jonothan Thomas Malay Jun. 1974 70 p refs
(AD-783666) Avail: NTIS CSCL 04/2

An attempt has been made to identify tropical waves with periods less than 20 days in the Indian Ocean by spectrum analysis of radiosonde data for five stations, widely scattered over the Indian Ocean area. The data used is for the period from January to September, 1973, which was further divided into five-month seasons, overlapping in May due to consideration of the monsoonal shift in the mean flow. Three spectral peaks in the 10-17 day, 6-7 day and 4-5 day ranges have been detected. Cross-spectrum analysis reveals a basically in-phase structure in the vertical in the lower troposphere and reversed phase at upper levels. (Modified author abstract) GRA

N74-34854# Environmental Research Inst. of Michigan, Ann Arbor.
BASIC INVESTIGATIONS FOR REMOTE SENSING OF COASTAL AREAS Quarterly Report, 15 Apr. - 15 Jul. 1974
Robert K. Vincent 26 Jul. 1974 6 p
(Contract N00014-74-C-2073; NR Proj. 389-166)
(AD-783710; ERIM-108900-1-L) Avail: NTIS CSCL 08/6

The purpose of this contract is to investigate remote sensing methods for monitoring coastal areas. The effort is divided into

three tasks, involving research on: Compositional mapping of beaches and river systems; multispectral radar imaging for coastal mapping; and enhancement of ocean bottom features with passive multispectral scanners. During the first quarter, significant progress was made on tasks 1 and 3, but work on task 2 has just begun, with nothing reportable as yet. GRA

N74-35055 Joint Publications Research Service, Arlington, Va.
SIMULATION OF HYDROLOGIC CHARACTERISTICS USING MARKOV CHAINS
V. I. Babkin and N. K. Serkov *In its* Meteorol. and Hydrol., No. 7, 1974 (JPRS-63109) 2 Oct. 1974 p 68-73 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 7, 1974 p 55-59 (For availability see N74-35046 24-20)

N74-35056 Joint Publications Research Service, Arlington, Va.
NADYM RIVER ISLANDS
A. A. Levashov *In its* Meteorol. and Hydrol., No. 7, 1974 (JPRS-63109) 2 Oct. 1974 p 74-80 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 7, 1974 p 60-65 (For availability see N74-35046 24-20)

N74-35057 Joint Publications Research Service, Arlington, Va.
EFFECT OF THE NEGATIVE COURSE OF WATER EVAPORATION FROM SOIL WITH A DRIED-OUT LAYER
Zh.-D. Dandaron *In its* Meteorol. and Hydrol., No. 7, 1974 (JPRS-63109) 2 Oct. 1974 p 81-91 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 7, 1974 p 66-73 (For availability see N74-35046 24-20)

N74-35059 Joint Publications Research Service, Arlington, Va.
SEASONAL FLUCTUATIONS OF THE OCEAN LEVEL
O. A. Andreyev, B. A. Kagan, and L. A. Ganesyan *In its* Meteorol. and Hydrol., No. 7, 1974 (JPRS-63109) 2 Oct. 1974 p 99-106 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 7, 1974 p 79-83 (For availability see N74-35046 24-20)

N74-35060 Joint Publications Research Service, Arlington, Va.
EFFECT OF HUMAN ACTIVITY ON THE THICKNESS OF SLUSH-AGGLOMERATED ICE ON RESERVOIRS
V. V. Piotrovich *In its* Meteorol. and Hydrol., No. 7, 1974 (JPRS-63109) 2 Oct. 1974 p 107-111 Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 7, 1974 p 83-86 (For availability see N74-35046 24-20)

N74-35061 Joint Publications Research Service, Arlington, Va.
BASIC PRINCIPLES OF THE METHOD OF CALCULATING MINIMUM RUNOFF INCLUDED IN THE SN435-72
A. M. Vladimirov *In its* Meteorol. and Hydrol., No. 7, 1974 (JPRS-63109) 2 Oct. 1974 p 112-115 Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 7, 1974 p 86-88 (For availability see N74-35046 24-20)

N74-35062 Joint Publications Research Service, Arlington, Va.
WATER LEVELING OF LAKES
Yu. A. Yelshin *In its* Meteorol. and Hydrol., No. 7, 1974 (JPRS-63109) 2 Oct. 1974 p 116-121 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 7, 1974 p 88-91 (For availability see N74-35046 24-20)

N74-35063 Joint Publications Research Service, Arlington, Va.
PROCEDURE FOR CALCULATING THE JOINT VARIATIONS IN GROUNDWATER RESERVES AND MOISTURE RESERVES OF THE AERATION ZONE
A. S. Subbotin *In its* Meteorol. and Hydrol., No. 7, 1974 (JPRS-63109) 2 Oct. 1974 p 122-126 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 8, 1974 p 91-93 (For availability see N74-35046 24-20)

N74-35070 Joint Publications Research Service, Arlington, Va.
PHYSICAL PRINCIPLES OF MODIFYING ATMOSPHERIC PROCESSES
L. G. Kachurin *In its* Meteorol. and Hydrol., No. 7, 1974 (JPRS-63109) 2 Oct. 1974 p 164-168 Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 7, 1974 p 114-116 (For availability see N74-35046 24-20)

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N74-34855 Stanford Univ., Calif.
THE STANFORD SYNTHESIS RATIO TELESCOPE: THEORY, CALIBRATION, AND DATA PROCESSING; AND A STUDY OF GALACTIC H 2 REGIONS Ph.D. Thesis
Larry Robert DAddario 1974 221 p
Avail: Univ. Microfilms Order No. 74-20184

The aperture synthesis technique of radio astronomical observation, is explored in some detail, with emphasis on the practical problems involved in making and interpreting such observations. Two major questions are treated theoretically: 1. How are the interferometric measurements of a synthesis observation related to the radiation from the sky? and 2. How can a finite set of such measurements be used to estimate the sky brightness, a continuous function? In analyzing the first question, special quantities are treated as three-dimensional vectors and tensors, thereby avoiding small-angle approximations employed in earlier treatments. Also, the concept of modified brightness is introduced as a convenient way to include the directional and polarization properties of non-ideal antennas. In the second question, various methods currently in use or proposed are analyzed and compared; these include the direct Fourier transform, various model fitting or representational methods, and probabilistic or maximum entropy methods. Dissert. Abstr.

N74-34856 New York Univ., N.Y.
THE MECHANISM OF FORMATION OF STRATOSPHERIC AEROSOLS Ph.D. Thesis
Robert Leifer 1973 89 p
Avail: Univ. Microfilms Order No. 74-15928

A model for the formation of stratospheric aerosols was developed using laboratory data. Trace quantities of SO2, NH3, O3, and H2O were irradiated for various periods of time and in different wavelength intervals. Results of these experiments provide the following information: (1) the quantum yield of the homogeneous oxidation of SO2 by O2 in the first strong band is less than 1.0 x 10 to the minus 10th power, (2) formation and stability of acid embryos are highly dependent on the available water vapor concentration, (3) experimental data for H2O4-H2O system indicates that concepts of equilibrium thermodynamics do not provide realistic estimates of heteromolecular rates, (4) SO2 and NH3 dark reactions do not play a significant role in the formation of stratospheric aerosols, and (5) trace organic materials may play a role in the formation of condensation nuclei when radiation of wavelengths below 2200 A is present.
Dissert. Abstr.

N74-34857* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FAST SCAN CONTROL FOR DEFLECTION TYPE MASS SPECTROMETERS Patent
Paul R. Yeager, Gianni Gaetano, and David B. Hughes, inventors (to NASA) (Bell and Howell Co., Pasadena, Calif.) Issued 10 Sep. 1974 7 p Filed 4 May 1973 Continuation-in-part of abandoned US Patent Appl. SN-188836, filed 31 Oct. 1971
(NASA-Case-LAR-11428-1; US-Patent-3,835,318; US-Patent-Appl-SN-357126; US-Patent-Class-250-281; US-Patent-Class-250-295; US-Patent-Appl-SN-188836) Avail: US Patent Office CSCL 14B

A high speed scan device is reported that allows most any scanning sector mass spectrometer to measure preselected gases at a very high sampling rate. The device generates a rapidly changing staircase output which is applied to the accelerator of the spectrometer and it also generates defocusing pulses that are applied to one of the deflecting plates of the spectrometer which when shorted to ground deflects the ion beam away from the collector. A defocusing pulse occurs each time there is a change in the staircase output.
Official Gazette of the U.S. Patent Office

N74-34858*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AN ELLIPSOMETER WITH VARIABLE ANGLE OF INCIDENCE FOR STUDIES IN ULTRAHIGH VACUUM
H. U. Walter, L. A. Weitzenkamp, and P. N. Peters 30 Aug. 1974 21 p refs
(NASA-TM-X-64884) Avail: NTIS HC $3.00 CSCL 14B

The windows for the vacuum chamber are incorporated into the optical bench system by means of flexible bellows which allow measurements to be made over a large range of angle of incidence, one of which is chosen so that maximum sensitivity is obtained. The principal angle of incidence was determined, and straightforward corrections for strain birefringence of vacuum chamber windows were made. Atomically clean surfaces of sodium chloride and lithium fluoride were investigated to verify the performance of the system. Submonolayer and monolayer coverage of water on these surfaces could be detected. On cleavage planes of NaCl, a first monolayer of adsorbed water is complete at about one torr only. Author

N74-34859*# Kansas Univ., Lawrence. Remote Sensing Lab.
ANALYSIS OF CONDITIONS FOR OPERATING THE S193 RAD/SCAT IN THE SOLAR POINTING MODE
James Pintar and Arun Sobti Jul. 1973 39 p
(Contract NAS9-13331)
(NASA-CR-140187; CRES-TR-243-3) Avail: NTIS HC $5.00 CSCL 14B

The S193 Rad/Scat, although initially programmed for operating in the earth pointing mode, can be operated in the solar pointing mode as well. The usual coordinate systems for describing the S193 in orbit are defined. The instructions for the operation of the radiometer and scatterometer are presented in terms of standard Euler angles for these coordinate systems. A sample analysis for the scatterometer is described. The relationships between the various Euler angles and physically meaningful orbit parameters are defined. Author

N74-34860*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
METHOD AND APPARATUS FOR DETECTING FLAWS IN ELONGATED BODIES Patent Application
Otto Buck (Rockwell Intern.), Richard V. Inman (Rockwell Intern.), George A. Alers (Rockwell Intern.), and Harris L. Marcus, inventors (to NASA) (Rockwell Intern.) Filed 24 Sep. 1974 13 p Sponsored by NASA
(NASA-Case-MFS-19218-1; US-Patent-Appl-SN-508803) Avail: NTIS HC $4.00 CSCL 14B

A nondestructive method and apparatus for use in detecting flaws in elongated bodies such as bars, tubes, and the like. The embodying method, and the apparatus provided for performing the method, facilitate flaw detection. This occurs through: (1) applying an axially directed oscillating magnetic force to the free end of a body being tested, (2) for exciting in the body a resonant vibration, (3) electrically sensing the vibration at two orthogonally related points near the free end of the body, and (4) comparing resultant electrical signals for revealing the presence of flaws. NASA

N74-34861*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RAPID ACTIVATION AND CHECKOUT DEVICE FOR BATTERIES Patent Appplication
William J. Britz and William A. Boshers, inventors (to NASA) Filed 27 Jun. 1974 13 p
(NASA-Case-MFS-22749-1; US-Patent-Appl-SN-483857) Avail: NTIS HC $4.00 CSCL 14B

An apparatus is described for activating a battery by inserting an electrolyte into the cells while making voltage measurements on each cell. The battery has a planar top with vertically extending passages providing access to the cells. It also has test points adjacent to each cell. A housing is mounted on top of the battery for supplying an electrolyte through sealed passages into the cells while simultaneously checking the voltage of the cells. The electrolyte is forced by pressure into the battery. NASA

N74-34862# National Aerospace Lab., Tokyo (Japan).
STUDY OF A ROTARY DRIVE VIBRATORY OUTPUT ACCELEROMETER
Hiroshi Yamada 1974 16 p refs In JAPANESE; ENGLISH summary
(NAL-TR-342) Avail: NTIS HC $4.00

An accelerometer is studied which has a rotary-drive vibratory-output in order to obtain inertial acceleration as an inertial guidance component of a rocket vehicle, as well as other such applications. The accelerometer has the advantage of eliminating cross coupling error based on acceleration along nonsensitive axes of the accelerometer. This unconventional accelerometer can be constructed by mounting a rotor having an unbalanced mass and a centrifugal pendulum in a gimbal. The moments of inertia of the rotor about its two principle axes in the plane of rotor rotation are nearly equal. If the rotor is spun, at a constant angular rate, about one of its principle axes and an acceleration is applied to the accelerometer with a component along the rotor axle, some vibratory moment is developed about a gimbal axis normal to the rotor spin axis. This moment is proportional to the sensed acceleration in magnitude, and has a phase that is related to the direction of the sensed acceleration along the spin axis. A unique, trial production, accelerometer using a centrifugal pendulum was produced and tested. Author

N74-34863# Witwatersrand Univ., Johannesburg (South Africa). School of Mechanical Engineering.
MEASUREMENT OF RAPIDLY VARYING DENSITY, AND HENCE TEMPERATURE, BY LASER INTERFEROMETRY IN THE UNBURNT GAS REGION OF A SPHERICAL CONSTANT VOLUME COMBUSTION VESSEL DURING FLAME PROPAGATION
A. M. Garforth Aug. 1974 69 p refs
(Rept-57; ISBN-0-85494-242-4) Avail: NTIS HC $6.50

A modified Michelson interferometer operating in the infinite fringe mode and using a helium-neon laser light source was used to measure transient density in a non-luminous gaseous mixture in which no large density gradients exist. The method will also yield measurements of transient temperature for isobaric processes, or when used in conjunction with a fast response pressure transducer. The technique was applied to the measurement of transient density in the unburnt gas region of a constant volume combustion bomb during flame propagation and yielded results with an experimental error significantly less than 1%. Typical results for measurements at a distance of 1.5 mm from the wall of the 160 mm diameter combustion vessel for a stoichiometric methane/air mixture are presented. Calibration data are included together with a full error analysis of the technique under different operating conditions. Author

N74-34864*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A METHOD AND APPARATUS FOR COMPENSATING REFLECTION LOSSES IN A PATH LENGTH MODULATED ABSORPTION-ABSORPTION TRACE GAS DETECTOR Patent Application
John Dimeff, inventor (to NASA) Filed 15 Oct. 1974 16 p
(NASA-Case-ARC-10631-1; US-Patent-Appl-SN-514546) Avail: NTIS HC $4.00 CSCL 14B

A method and apparatus is described for compensating for reflection losses in an optical path length modulated absorption-absorption gas analyzer used for determining the density of a reference gas in an unknown gas sample. The apparatus comprises a first chamber for containing a first gas including a reference gas at a known partial density and a second chamber for containing a second gas. A source of radiant energy is provided for passing radiant energy through the first and second chambers. Means are provided for modulating the path length of the radiant energy in the chambers. Additionally, a chopper wheel comprising a plurality of gas cells containing a sample of the reference gas is interspersed by a plurality of gas cells containing a gas excluding the reference gas. NASA

N74-34865*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGH-RESPONSE ON-LINE GAS ANALYSIS SYSTEM FOR HYDROGEN-REACTION COMBUSTION PRODUCTS
Allen J. Metzler and Raymond E. Gaugler Washington Oct. 1974 16 p refs

(NASA-TM-X-3123; E-8014) Avail: NTIS HC $3.00 CSCL 14B

The results of testing an on-line quadrupole gas analyzer system are reported. Gas samples were drawn from the exhaust of a hydrogen-oxygen-nitrogen rocket which simulated the flow composition and dynamics at the combustor exit of a supersonic combustion ramjet engine. System response time of less than 50 milliseconds was demonstrated, with analytical accuracy estimated to be + or - 5 percent. For more complex chemical systems with interfering atom patterns, analysis would be more difficult. A cooled-gas pyrometer probe was evaluated as a total temperature indicator and as the primary mass flow measuring element for the total sample flow rate. Author

N74-34866*# Illinois Univ., Urbana. Aeronomy Lab.

DESIGN AND CALIBRATION OF A ROCKET-BORNE ELECTRON SPECTROMETER FOR INVESTIGATION OF PARTICLE IONIZATION IN THE NIGHTTIME MIDLATITUDE E REGION

H. D. Voss and L. G. Smith 1 Oct. 1974 239 p refs

(Grant NGR-14-005-181)

(NASA-CR-140579; Aeronomy-62; UILU-ENG-74-2505) Avail: NTIS HC $15.00 CSCL 14B

An explanation was developed for the formation, near midnight at midlatitudes, of a broad electron density layer extending approximately from 120 to 180 km and usually referred to as the intermediate E layer. The responsible mechanism is believed to be the converging vertical ion drifts resulting from winds of the solar semidiurnal tide. Numerical solutions of the continuity equation appropriate to the intermediate layer is described for particular models of ion drift, diffusion coefficents, and ionization production. Analysis of rocket observations of the layer show that the ionization rate is highly correlated with the planetary geomagnetic index, K sub p. Particle flux measurements support the idea that energetic electrons are the principal source of this ionization. A semiconductor spectrometer experiment for investigation of the particle flux, spectrum, and angular properties was designed and successfully flown on a Nike Apache rocket. A detailed description of the theory, design, and calibration of the experiment and some preliminary results presented. Author

N74-34867# Osservatorio Astronomico, Rome (Italy).

AN INTEGRAL PHOTOGRAPHIC METHOD FOR DETERMINING THE LUMINOUS CONTRAST OF PHOTOSPHERIC MICROSTRUCTURES [METODO FOTOGRAFICO INTEGRALE PER LA DETERMINAZIONE DEL CONTRASTO LUMINOSO DELLE MICROSTRUTTURE FOTOSFERICHE]

Vincenzo Croce Nov. 1973 11 p refs In ITALIAN Presented at the 59th Congr. Nazl. della Soc. Ital. di Fis.

(RR-14) Avail: NTIS HC $4.00

A method for the photometric measurement of transparency applied to the photographic images of randomly granular structure is described. A reticle was used to demonstrate the concordance with the photosphere granulation images. It is shown that the method is suitable for the reconstruction of fundamental spatial frequency of the structure, luminosity, photometric contrast of alterated images. ESRO

N74-34868# North Carolina State Univ., Raleigh.

EXPERIMENTAL DETERMINATION OF DYNAMIC STRESS-STRAIN RELATIONSHIPS DURING WAVE PROPAGATION IN BRITTLE MATERIALS Technical Report, 1 Sep. 1967 - 31 Aug. 1974

R. S. Steele and R. A. Douglas Jun. 1974 131 p refs

(Contract N00014-68-A-0187; NR Proj. 064-504)

(AD-782577; TR-74-1) Avail: NTIS CSCL 14/2

This report describes in detail the calibration and application of the foil manganin alloy gage for monitoring dynamic one dimensional stresses in axially impacted rods. The total response of the gage is shown to have both a normal stress component and a plane strain component. Tests are described which determine the relationship between these components and the total response. Limits on the usable strain and stress ranges of the manganin gage are also listed. Using the manganin stress gage, dynamic stress-strain curves are found for borosilicate and soda lime glasses, South African black granite, and 7075-T6 aluminum. Strain rates as large as -1500/sec and loading times of 10 microseconds are used. Finally, the resulting dynamic elastic modules are compared with quasi-static values and dynamic values determined at small strain rates for those materials. (Modified author abstract) GRA

N74-34869# Army Foreign Science and Technology Center, Charlottesville, Va.

PHOTOGRAPHIC COLOR SEPARATION AND COLOR CORRECTING

T. O. Svetlova, E. M. Margolin, and Yu. P. Selivanov 24 Apr. 1974 12 p refs Transl. into ENGLISH from Poligrafiya (USSR), no. 2, 1971 p 25-28

(AD-782088; FSTC-HT-23-1197-73) Avail: NTIS CSCL 14/5

A review of a new method for color separation and color correction in printing is described. Primary exposure is done, development is carried out with a Chibisov developer, more treatment is done and a secondary exposure follows. When tested against normal methods, it was found that the new method gave better color rendition, especially in light blue, orange and green. GRA

N74-34870# General Electric Co., Wilmington, Mass. Aerospace Instruments and Product Support Dept.

INTEGRATED ENGINE INSTRUMENT SYSTEM Final Report, 29 Aug. 1972 - 30 Nov. 1973

R. L. Skovholt, D. E. Berglund, W. A. Doerle, W. R. Hiatt, and F. P. Johnson Dec. 1973 228 p

(Contract N62269-73-C-0135)

(AD-783683; DF73AEE189-Vol-1) Avail: NTIS CSCL 01/3

A two-volume report documents the Phase 3 effort for the integrated engine instrument system (IEIS). IEIS is a computer-driven display and processing instrumentation system concerned with monitoring the aircraft engine's conditions in response to the anticipated needs of flight crew and maintenance personnel in the 1980-85 timeframe. Volume 1 covers engine analysis, including such topics as assumptions, subsonic missions, gas path, mechanical measurement, airborne computer operations, diagnostics, data recording, maintenance indication, fault isolation, gross thrust factor, airborne display, recommendations, and long term trending. Next, system design is discussed, involving requirements, vibration and temperature monitoring, data transmission, software and hardware, costs, program time and routines, reliability, recording, and an introduction to functions performed. GRA

N74-34871# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.

ADVANCED CONCEPTS IN STRUCTURAL MATERIALS AND TESTING. PART 1: THE APPLICATION OF RANDOM SIGNAL CORRELATION TECHNIQUES TO ULTRASONIC FLAW DETECTION IN SOLIDS Annual Technical Report, 1 Jun. 1973 - 31 May 1974

Vernon L. Newhouse, E. S. Furgason, and N. M. Bilgutay 15 Jul. 1974 44 p refs

(Grant DAHC15-73-G-12; ARPA Order 2338)

(AD-782349) Avail: NTIS CSCL 14/2

The work performed under this program can be subdivided into two areas. The first deals with the application of random signal correlation techniques to ultrasonic flaw detection in solids and the second deals with the development of modulated microstructure heat treatable steel. A random signal ultrasonic flaw detection system, has been constructed and operated. It has been demonstrated that the resolution of the system is independent of the length of the transmitted signal. This indicates that a much lower peak to average power ratio can be used than is possible with pulse-echo systems. (Modified author abstract) GRA

N74-34872# Army Foreign Science and Technology Center, Charlottesville, Va.

ON THE NECESSARY NUMBER AND OPTIMUM LOCATION OF FIDUCIAL MARKS IN AN AERIAL PHOTOGRAPHIC APPEARANCE

O. V. Portnova 24 Apr. 1974 17 p Transl. into ENGLISH from Geod. i Kartografiya (USSR), no. 4, 1973 p 39-47

(AD-783834; FSTC-HT-23-275-74) Avail: NTIS CSCL 14/5

Studies on the optimum number and location of fiducial marks in an aerial photographic apparatus showed that it is possible to obtain minimum residual distortions of the coordinates

and altitude distortions when 16 fiducial marks are used, and when the non-linear technique is used for calculating the distortions. When the non-linear technique of calculating distortions is adopted, using eight marks along the perimeter at a distance of 8 cm from each other, the residual errors will amount to plus or minus 0.010 mm on the photograph surface and to 1/7,000 to 1/11,000H in the altitude. If the number of fiducial marks on the perimeter of the picture is increased above 16, this will not increase the precision of determination of the coordinates. GRA

N74-34873# Oregon State Univ., Corvallis. School of Oceanography.
EXPOSURE: A NEWSLETTER FOR OCEAN TECHNOLOGISTS. VOLUME 2, NO. 3: AIRCRAFT EXPENDABLE BATHYTHERMOGRAPHS USED IN NORPAX EXPERIMENT
Roderick Mesecar Jul. 1974 14 p ref
(Contract N00014-67-A-0369-0007; NR Proj. 083-102)
(AD-783591) Avail: NTIS CSCL 08/10

Contents: Aircraft expendable bathythermographs used in NORPAX experiment; A shipboard self-contained profiling system; Measurement of currents in a coastal upwelling zone with parachute drogues. GRA

N74-34804 Joint Publications Research Service, Arlington, Va.
PHOTOGRAPHIC EXPERIMENTS DURING MULTIDAY SPACESHIP FLIGHT
V. I. Sevastyanov *In its* Geodesy and Aerial Phot., 1972 (JPRS-63013) 19 Sep. 1974 p 97-100 Transl. into ENGLISH from Izv. Vyssch. Ucheb. Zaved., Geod. Aerofotos. (Moscow), no. 6, 1972 p 69-71 (For availability see N74-34798 24-13)

N74-34805 Joint Publications Research Service, Arlington, Va.
DEVELOPMENT OF AERIAL SURVEYING
Docent N. P. Lavrova and M. D. Konshin *In its* Geodesy and Aerial Phot., 1972 (JPRS-63013) 19 Sep. 1974 p 101-113 Transl. into ENGLISH from Izv. Vyssch. Ucheb. Zaved., Geod. Aerofotos. (Moscow), no. 6, 1972 p 73-81 (For availability see N74-34798 24-13)

N74-34806 Joint Publications Research Service, Arlington, Va.
PROBLEMS AND PROSPECTS IN THE DEVELOPMENT OF PHOTOGRAMMETRY
F. V. Drobyshev and A. N. Lobanov *In its* Geodesy and Aerial Phot., 1972 (JPRS-63013) 19 Sep. 1974 p 114-123 Transl. into ENGLISH from Izv. Vyssch. Ucheb. Zaved., Geod. Aerofotos. (Moscow), no. 6, 1972 p 83-89 (For availability see N74-34798 24-13)

N74-34808 Joint Publications Research Service, Arlington, Va.
WAYS TO DEVELOP GEODETIC INSTRUMENT MAKING
S. V. Yeliseyev *In its* Geodesy and Aerial Phot., 1972 (JPRS-63013) 19 Sep. 1974 p 138-150 Transl. into ENGLISH from Izv. Vyssch. Ucheb. Zaved., Geod. Aerofotos. (Moscow), no. 6, 1972 p 107-115 (For availability see N74-34798 24-13)

N74-34809 Joint Publications Research Service, Arlington, Va.
OPTICS IN GEODESY AND PHOTOGRAMMETRY
N. P. Zakaznov *In its* Geodesy and Aerial Phot., 1972 (JPRS-63013) 19 Sep. 1974 p 151-156 refs Transl. into ENGLISH from Izv. Vyssch. Ucheb. Zaved., Geod. Aerofotos. (Moscow), no. 6, 1972 p 117-120 (For availability see N74-34798 24-13)

N74-34810 Joint Publications Research Service, Arlington, Va.
OPTICAL-ELECTRONIC INSTRUMENTS IN GEODESY
Yu. G. Yakushenkov *In its* Geodesy and Aerial Phot., 1972 (JPRS-63013) 19 Sep. 1974 p 157-167 refs Transl. into ENGLISH from Izv. Vyssch. Ucheb. Zaved., Geod. Aerofotos. (Moscow), no. 6, 1972 p 121-127 (For availability see N74-34798 24-13)

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection.

N74-34874*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
DESIGN, FABRICATION, ASSEMBLY, AND TEST OF A LIQUID HYDROGEN ACQUISITION SUBSYSTEM
J. B. Blackman May 1974 257 p refs
(Contract NAS8-27571)
(NASA-CR-120447; MDC-G5360) Avail: NTIS HC $16.00 CSCL 13H

The development of a cryogenic fluid system to supply liquid hydrogen to a turbopump at flowrates up to 7.5 pounds per second for a period of approximately 5 seconds before refill, is discussed. Refill is accomplished in less than 10 seconds, during which a constant flowrate can be maintained to the pumps. Diagrams are provided to show the configuration of the system. Subsystem acceptance and functional tests, including acquisition subsystem expulsion, pressurization, and refill were performed. The tests included: (1) thermodynamic vent system operation, (2) warm-gas pressurization effects, (3) hydraulic pressure surge effects, (4) screen device operational limitations, (5) feedline vapor control, and (6) two-phase refill. Author

N74-34875*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EVALUATION OF GROUND CHARACTERIZATION SAMPLES MCN-2 AND MCN-3, SECTION 1
[1973] 56 p
(NASA-TM-X-70381) Avail: NTIS HC $6.00 CSCL 13H

A detailed metallurgical evaluation of two exothermically brazed nickel ground characterization samples was conducted. Samples MCN-2 and MCN-3 were among six samples that were brazed as part of a exothermic brazing experiment to obtain baseline data for use in determining the effect of weightlessness on: (1) the wetting and flow behavior of brazing filler metals; and (2) the metallurgical characteristics of the brazed joints. The samples were evaluated by metallographic examination and electron microprobe analysis. Author

N74-34876*# Lockheed Missiles and Space Co., Huntsville, Ala. Fluid Mechanic Applications Group.
RESEARCH STUDY ON MATERIALS PROCESSING IN SPACE EXPERIMENT M512 Final Report
M. R. Brashears and S. J. Robertson Dec. 1973 134 p refs
(Contract NAS8-28729)
(NASA-CR-120185; TR-D-306954) Avail: NTIS HC $4.75 CSCL 13H

A study program was conducted to clarify the role of gravity in the fluid mechanics of certain molten metal processes of potential significance to manufacturing in space. In particular, analyses were conducted of the M551 Metals Melting Experiment and the M553 Sphere Forming Experiment to be conducted in the M512 Facility onboard Skylab. The M551 experiment consisted of a study of electron beam welding of various metals, and the M553 experiment studied the formation of molten metal spheres by free-floating in a near zero-gravity environment. The analyses of these experiments and a comparison with ground-based and KC135 experimental results are presented. Author

N74-34877*# Georgia Inst. of Tech., Atlanta.
CHARACTERIZATION OF NICKEL-COPPER ALLOY SPECIMENS PROCESSED AS A PART OF THE M553 SPHERE FORMING EXPERIMENT DURING THE SKYLAB 1 AND 2 FLIGHT Summary Report
J. L. Hubbard, J. W. Johnson, and J. L. Brown Dec. 1973 32 p
(Contract NAS8-28735)
(NASA-CR-129039) Avail: NTIS HC $3.25 CSCL 13H

Both processed nickel-copper alloy specimens apparently completely melted by the electron beam in the Skylab M512 materials processing facility and either floated free in space, but

collided with some smooth flat surface before solidifying, or remained attached to its support post during solidification. Both specimens had a smooth flat area on the surface due to this adherence during solidification. The nominal composition of the alloy before processing in space was 70 percent Ni and 30 percent Cu. Tests show that a considerable amount of copper was lost during processing by evaporation. It was further found that less copper was present in the cap areas, particularly at the surface, than was in the remainder of the specimens. The microchemistry of the dendrites and interdendritic regions, however, is in agreement with the phase diagram for this alloy. The measured densities of these specimens were less than the theoretical density of the alloy due to the amount of porosity present, however, no large voids were found by radiographic techniques. Author

N74-34878*# Georgia Inst. of Tech., Atlanta.
CHARACTERIZATIONS OF FOUR SPECIMENS PROCESSED AS A PART OF THE M553 SPHERE FORMING EXPERIMENT PERFORMED DURING THE SKYLAB 1 AND 2 FLIGHT Summary Report
J. L. Hubbard, J. W. Johnson, and J. L. Brown Dec. 1973 49 p
(Contract NAS8-28735)
(NASA-CR-129040) Avail: NTIS HC $3.25 CSCL 13H

Four specimens identified as SL-1.3, SL-1.8, SL-1.9 and SL-2.5 were submitted for metallurgical characterization. These specimens had been processed in the M512 Facility as a part of the M553 Sphere Forming Experiment performed during the Skylab 1/2 flight. Three of these specimens, SL-1.3, SL-1.8, and SL-2j5 were designed to be melted completely by the electron beam and detach themselves from their support posts and resolidify while floating free in the near zero gravity and vacuum environment of space. Specimens SL-1.3 and SL-1.8 were completely melted, but it is believed they did not leave their posts before solidifying. Specimen SL-2.5 was only partially melted. Specimen SL-1.9 was to be completely melted and retained on a large sting which was accomplished as planned. The nominal composition of the four specimens was: (1) SL-1.3 - Ni 12% Sn; (2) SL-1.8 - Ni 30% Cu; (3) SL-1.9 - Pure Ni; and (4) SL-2.5 - Pure Ni. These four specimens have been examined according to the Phase B Characterization Plan. The results are discussed and compared with similar characterization analyses run on ground base specimens. Author

N74-34879# Joint Publications Research Service, Arlington, Va.
SOME SOVIET EXAMPLES OF UNDERWATER TECHNOLOGY
V. Shabalin 3 Oct. 1974 22 p refs Transl. into ENGLISH from Ekspress-Inform. (Moscow), ser. 9, no. 18, 1972 p 1-21 (JPRS-63114) Avail: NTIS HC $4.25

The development of remotely controlled underwater vehicles for geologic research, fisheries purposes, emergency rescue, and vessel salvaging operations is discussed. Also described is an underwater habitat designed for the life support of five aquanauts. G.G.

N74-34880*# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
RESEARCH STUDY ON MATERIALS PROCESSING IN SPACE EXPERIMENT NUMBER M512 Special Summary Report on M551, M552, and M553 (adhesion-cohesion phenomena)
J. Martin Tobin Mar. 1974 26 p
(Contract NAS8-28730)
(NASA-CR-120480) Avail: NTIS HC $3.25 CSCL 13H

Conclusions of the team of specialists can be generalized as: (1) Brazing and welding of metal structures in an orbital near zero gravity condition are quite feasible. (2) Design of joints for fabrication in zero gravity will place less emphasis on the tolerances and proximity of the adjacent structures than on the quantity of liquid metal available. (3) Brazing of metallic joints has many advantages over electron beam welding for practical reasons: simplicity, launch weight, development costs, joint design tolerances, remotization, etc. (4) No evidence of different physical or mechanical properties of liquid metals in zero gravity was observed. However, many differences in liquid behavior were observed. Many of these effects have been called adhesion-cohesion phenomena. Author

N74-34881*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MINIATURE HYDRAULIC ACTUATOR Patent Application
Francis D. Sevart, inventor (to NASA) (Boeing Co.) Filed 10 Oct. 1974 13 p Sponsored by NASA
(NASA-Case-LAR-11522-1; US-Patent-Appl-SN-513689) Avail: NTIS HC $4.00 CSCL 13I

A miniature reversible rotary actuator is reported that operates by hydraulic fluid pressure. A shaft mounted vane is free to displace angularly within a chamber under the influence of fluid pressure introduced at either extremity of the chamber. When appropriate internal and external sealing is used, the actuator is capable of exerting a very high torque in either rotative direction relative to its size and weight. Use of an incompressible actuating fluid enables it to be used as a precision positioner and to respond quickly and accurately to changes in fluid pressure inputs. Author (NASA)

N74-34882*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AN EXTERNALLY SUPPORTED INTERNALLY STABILIZED FLEXIBLE DUCT JOINT Patent Application
James R. Rollins, inventor (to NASA) (Rocketdyne) Filed 27 Jun. 1974 15 p Sponsored by NASA
(NASA-Case-MFS-19194-1; US-Patent-Appl-SN-483850) Avail: NTIS HC $4.00 CSCL 13E

A description is given of an externally supported internally stabilized flexible duct joint particularly suited for use in conducting the flow of fluid between a pair of tubular conduits, at least one of which is supported for motion relative to the other. The joint is characterized by a low-flow loss coefficient and includes a pair of coaxially related terminal sleeves adapted to be coupled with adjacently disposed conduits, and an elongated bellows extended between the terminal sleeves. The bellows is supported against thrust induced extension by linkage including a gimbal ring concentrically related to the mid-span of the bellows and a pair of terminal supports affixed to the terminal sleeves and journaled to the gimbal ring. A bellows stabilizing sleeve is disposed within the bellows for avoiding flow impingement and preventing lateral shifting while a support ring is mounted on the stabilizing sleeve and connected to the mid-span of the bellows for connecting the bellows with the stabilizing sleeve. NASA

N74-34883*# California State Univ., Northridge.
EXPERIMENTAL EVALUATION OF STRESSES IN CYLINDRICALLY HOLLOW (DRILLED) BALLS Final Report
L. J. Nypan Washington NASA Aug. 1974 129 p refs
(Grant NGL-05-062-002)
(NASA-CR-2439) Avail: NTIS HC $4.75 CSCL 13I

An experimental stress analysis was undertaken to evaluate stresses within cylindrically hollow (drilled) bearing balls proportioned for 40, 50, and 60 percent mass reductions. Strain gage rosettes were used to determine principal strains and stresses in the steel ball models statically loaded in various orientations. Results are reported for 127 mm OD balls under 44,500 N loads. Similitude considerations permit these results to be applied to calculate stresses in actual size drilled bearing balls proportioned to these mass reductions. Author

N74-34884# National Aerospace Lab., Tokyo (Japan).
EFFECT OF ATMOSPHERE ON BOUNDARY LUBRICATION
Makoto Nishimura and Yutaka Matsumoto 1974 25 p refs In JAPANESE; ENGLISH summary
(NAL-TR-348) Avail: NTIS

Lubricating properties of iron and copper lubricated with a mineral oil with or without 0.1% stearic acid and with a dimethyl silicone were studied in air and in vacuum up to 1 million torr by using a pin on disc friction and wear machine. Load carrying capacities of the same oils were tested using a cross-cylinder load carrying tester also in air and in vacuum. The results obtained are as follows: (1) With the mineral oil the friction and wear of the copper test pieces was minimum in the atmospheric pressure and increased with the reduction of the

ambient pressure, while with the oil containing 0.1% stearic acid it was almost constant in the tested pressure range. It increased only when the specimen was kept for more than four hours in 10 to the 6th to 10 to the 7th power torr before the test. (2) The iron test pieces did not show such marked differences in the friction and were as the copper test pieces by the presence of 0.1% stearic acid. (3) In contrast to the mineral oil the friction and wear of the iron test pieces lubricated with the dimethyl silicone was lower in vacuum than in air, but much higher than with the mineral oil. (4) The copper test pieces, which were heated to 100 C for 5 min. in 1 million torr, cooled to room temperature and then painted the oil with 0.1% stearic acid, showed high friction and wear, indicating that the stearic acid loses its effect without adsorbed water layer on the surfaces.
Author

N74-34885*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE APPLICATION OF ACOUSTIC EMISSION TECHNIQUE TO FATIGUE CRACK MEASUREMENT
Jag J. Singh, William T. Davis, and John H. Crews, Jr. Washington Oct. 1S74 42 p refs
(NASA-TN-D-7695; L-9530) Avail: NTIS HC $3.25 CSCL 20K

The applicability of acoustic emission technique to measure fatigue cracks in aluminum alloy specimens was investigated. There are several variables, such as the metallurgical and the physical treatment of the specimen, that can affect the level of acoustic activity of a fatigue specimen. It is therefore recommended that the acoustic emission technique be supplemented by other nondestructive evaluation methods to obtain quantitative data on crack growth.
Author

N74-34886*# Amicon Corp., Lexington, Mass.
DEVELOPMENT OF AN IMPROVED MEMBRANE FOR A VAPOR DIFFUSION WATER RECOVERY PROCESS Final Report
Thomas R. Rich and Thomas W. Mix Aug. 1974 80 p refs (Contract NAS2-7649)
(NASA-CR-137544) Avail: NTIS HC $7.00 CSCL 13B

Recovery of potable water from urine on manned space missions of extended duration was the objective of work aimed at the improvement of membrane performance for the vapor diffusion process (VDR). Kynar, Teflon, PVC, and polysulfone candidate membranes were evaluated from chemical, thermal, mechanical, and fabricating standpoints to determine their suitability for operation in the VDR pervaporation module. Pervaporation rates and other performance characteristics were determined in a breadboard pervaporator test rig. Kynar and Teflon membranes were demonstrated to be chemically stable at pervaporation temperatures in urine pretreated with chromic acid bactericide. The separation of the pervaporator and condenser modules, the use of a recirculating sweep gas to conduct pervaporate to the condenser, and the selection of a hollow fiber membrane configuration for pervaporator module design is recommended as a result of the investigation.
Author

N74-34887*# Ionics, Inc., Watertown, Mass.
WATER VAPOR DIFFUSION MEMBRANE DEVELOPMENT Final Report, 1 Jul. 1973 - 31 Mar. 1974
Michael K. Tan Apr. 1974 99 p refs
(Contract NAS2-7651)
(NASA-CR-137546) Avail: NTIS HC $8.00 CSCL 13B

The phase separator component used as a membrane in the vapor diffusion process (VRD) for the recovery of potable water from urine on manned space missions of extended duration was investigated, with particular emphasis on cation-selective membranes because of their noted mechanical strength, superior resistance to acids, oxidants, and germicides, and their potential resistance to organic foulants. Two of the membranes were tested for 700 hours continuously, and were selected on the basis of criteria deemed important to an effective water reclamation system onboard spacecraft. The samples of urine were successfully processed by removing 93 percent of their water content in 70 hours using the selected membranes. Pretreatment with an acid-oxidant formulation improved product quality. Cation exchange membranes were shown to possess superior mechanical strength and chemical resistance, as compared to cellulosic membranes.
Author

N74-34888*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OPTIMIZATION OF SELF-ACTING HERRINGBONE-GROOVED JOURNAL BEARINGS FOR MAXIMUM STABILITY
David P. Fleming and Bernard J. Hamrock Washington Oct. 1974 24 p refs
(NASA-TN-D-7803; E-7793) Avail: NTIS HC $3.00 CSCL 13I

Groove parameters were determined to maximize the stability of herringbone-grooved journal bearings. Parameters optimized were groove depth, width, length, and angle. Optimization was performed by using a small-eccentricity, infinite-groove analysis in conjunction with a previously developed Newton-Raphson procedure for bearings with the smooth member rotating or with the grooved member rotating at low compressibility numbers, and a newly developed vector technique for bearings with the grooved member rotating at high compressibility numbers. The design curves in this report enable one to choose the optimum bearing for a wide range of operating conditions. Compared with bearings optimized to maximize load capacity, bearings optimized for stability allow a thousandfold increase in bearing-supported mass in some cases before onset of instability, and lose no more than 77 percent of their load capacity in any case studied. Stability is much greater when the grooved member rotates.
Author

N74-34889*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ROLLING-ELEMENT FATIGUE LIFE OF SILICON NITRIDE BALLS
Richard J. Parker and Erwin V. Zaretsky Washington Oct. 1974 19 p refs
(NASA-TN-D-7794; E-7219) Avail: NTIS HC $3.00 CSCL 13I

The five-ball fatigue tester was used to evaluate silicon nitride as a rolling-element bearing material. Results indicate that hot-pressed silicon nitride running against steel may be expected to yield fatigue lives comparable to or greater than those of bearing quality steel running against steel at stress levels typical rolling-element bearing application. The fatigue life of hot-pressed silicon nitride is considerably greater than that of any ceramic or cermet tested. Computer analysis indicates that there is no improvement in the lives of 120-mm-bore angular--contact ball bearings of the same geometry operating at DN values from 2 to 4 million where hot-pressed silicon nitride balls are used in place of steel balls.
Author

N74-34890# Environmental Protection Agency, Research Triangle Park, N.C.
ENGINEERING AND COST STUDY OF THE FERROALLOY INDUSTRY
James O. Dealy and Arthur M. Killin May 1974 410 p refs
(EPA-450/2-74-008) Avail: NTIS HC $23.50

Studies of several ferroalloy plants were made to provide information about the following aspects of the industry: (1) atmospheric emissions from production of ferroalloys and calcium carbide; (2) methods and equipment used to limit these emissions; (3) cost and economic impact of air pollution controls; and (4) industry characteristics such as growth rate, raw materials, processes, consumer products, and number and location of producers. The information was gathered from industry questionnaires and EPA source tests.
Author

N74-34891*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FERROGRAPHIC ANALYSIS OF WEAR DEBRIS FROM BOUNDARY LUBRICATION EXPERIMENTS WITH A FIVE-RING POLYPHENYL ETHER
William R. Jones, Jr. Washington Oct. 1974 28 p refs
(NASA-TN-D-7804; E-8007) Avail: NTIS HC $3.25 CSCL 11H

The types of wear particles generated by a five-ring polyphenyl ether in boundary lubrication experiments in various atmospheres were determined by ferrographic analysis. The types of wear

particles observed included cylindrical or rocklike organometallic debris, adhesive and cutting wear particles, and some spherical debris. Interpretations as to the mechanism of generation of the various types of particles are presented. Author

N74-34892*# USM Corp., Wakefield, Mass. Gear Systems Div.
ENGINEERING ANALYSIS AND TEST RESULTS OF THE PRE-STAGE PLANETARY GEAR TRAINS FOR WRIST ROTATION AND PITCH ASSEMBLY AND AZIMUTH AND ELEVATION ASSEMBLY OF THE EXTENDABLE STIFF ARM MANIPULATOR KIT ASSEMBLY Final Report
R. N. Morris 12 Nov. 1973 51 p refs
(Contract NAS8-29631)
(NASA-CR-120499; USM-8-29631-FR) Avail: NTIS HC $5.75 CSCL 13I

In order to improve the performance capability of the Extendable Stiff Arm Manipulator (ESAM) it was necessary to increase the overall gear ratio by a factor of approximately four. This is accomplished with minimum effect to existing hardware by the interposition of a planetary gear transmission between the respective drive motors and the harmonic drive transmissions. The engineering analysis in support of this design approach and the subsequent no-load test results are reported. Author

N74-34893# Commissariat a l'Energie Atomique, Saclay (France).
ELECTRON BEAM WELDING
P. Martin Sep. 1973 34 p In FRENCH Presented at the Conf. at the Municipal Library, Lyon, France
(CEA-Conf-2523; Conf-731069-1) Avail: AEC Depository Libraries HC $3.75

The principles of electron beam welding are given and questions of welding parameters are answered. Problems of weldability and faults are considered along with principle qualities and limitations of the technique. Transl. by E.H.W.

N74-34894# California Univ., Berkeley. Operations Research Center.
ON TIME TO FIRST FAILURE IN MULTICOMPONENT EXPONENTIAL RELIABILITY SYSTEM
Sheldon M. Ross Mar. 1974 17 p refs
(Contracts N00014-69-A-0200-1036; DA-31-124-ARO(D)-331; NR Proj. 042-238)
(AD-781906; ORC-74-8) Avail: NTIS CSCL 14/4

Consider an n component reliability system having the property that at any time each of its components is either up (i.e., working) or down (i.e., being repaired). Each component acts independently and it is supposed that each time the ith component goes up it remains up for an exponentially distributed time having mean (mu sub i), and each time it goes down it remains down for an exponentially distributed time having mean (v sub i). It is further supposed that whether or not the system itself is up at any time depends only on which components are up at that time. The author is interested in the distribution of the time of first system failure when all components are initially up at time zero. (Modified author abstract) GRA

N74-34895# Frankford Arsenal, Philadelphia, Pa.
ION BEAM OPTICAL POLISHING SYSTEM COMPUTER PROGRAMS
James D. Lester Nov. 1973 66 p refs
(AD-781959; FA-R-2096) Avail: NTIS CSCL 13/8

A low energy ion beam accelerator system has been developed for fabrication of precision optical elements. This system forms optical surfaces by means of computer controlled sputtering and optical reticles by means of computer controlled implantation. The source language computer programs used to drive the accelerator are listed and described. Author (GRA)

N74-34896# Ampex Corp., Redwood City, Calif. Corporate Research Dept.
FOIL BEARING INVESTIGATION. STUDY OF TAPE BEHAVIOR IN VACUUM COLUMNS. ANALYSIS OF THE CONTOUR OF A STATIONARY TAPE IN VACUUM COLUMNS
A. Eshel Jul. 1974 28 p
(Contract N00014-71-C-0001; NR Proj. 062-297)
(AD-782427; RR-73-04) Avail: NTIS CSCL 13/9

The contour of a stationary, infinitely wide thin foil in a vacuum column is analyzed. It is shown that for the case of greatest practical interest the analysis must take into account the bending rigidity of the foil. The analysis is carried out by assuming the tape contour to be a small perturbation from a prescribed reference contour Conditions for the foil to lift off the wall, to form point-contact or line-contact with the wall, are studied for a range of geometric and elastic parameters. Author (GRA)

N74-34897# Ampex Corp., Redwood City, Calif. Corporate Research Dept.
FOIL BEARING INVESTIGATION. STUDY OF TAPE BEHAVIOR IN VACUUM COLUMNS. APPLICATION OF FOIL BEARING THEORY TO VACUUM COLUMNS Interim Report
A. Eshel Jul. 1974 19 p
(Contract N00014-71-C-0001; NR Proj. 062-297)
(AD-782424; RR-74-06) Avail: NTIS CSCL 13/9

Steady-state tape-to-wall separation in tape-drive vacuum-columns is analyzed for the case that the tape forms a flat zone near the wall. It is shown how formulae may be derived from foil bearing theory to predict film thickness. It is concluded that film thickness may vary substantially for the two walls of the vacuum chamber. Author (GRA)

N74-34898# Naval Research Lab., Washington, D.C.
TESTING WIRE ROPE: MEASUREMENT SYSTEM AND EXPERIMENTAL STUDY Final Report
D. A. Milburn and R. K. Samras 21 Jun. 1974 21 p refs (RR02303)
(AD-782515; NRL-7762) Avail: NTIS CSCL 13/9

A measurement system for testing wire rope in support of research on wire rope and cables was developed at NRL. The system is used to measure rope variables (tensile load, torque, elongation, and rotation) for different test specimen and restraints, either clamped or swiveled. The measurement system was applied to an experimental investigation. The objective of this study was to determine the constitutive constants of a 3/4-in. diameter wire rope. This work was done to supplement an analytical investigation of coupled extensional-torsional oscillations in wire rope. Author (GRA)

N74-34899# McDonnell Aircraft Co., St. Louis, Mo.
EVALUATION OF SHEAR-SPUN Ti-3Al-2.5V TITANIUM ALLOY HYDRAULIC TUBING Final Report, Jul. 1973 - Apr. 1974
L. R. Sanders May 1974 23 p refs
(Contract F33615-72-C-1923; AF Proj. 7381)
(AD-783352; AFML-TR-74-102) Avail: NTIS CSCL 13/11

The objective of the program was to evaluate hydrostatically extruded Ti-3Al-2.5V hydraulic tubing. However, shear-spun tubing had to be substituted for evaluation. Tests conducted on the shear-spun tubing included rotary flexure and impulse fatigue, flaring, bending, flattening, and tensile strength. The shear-spun tubing was found to be inferior to conventionally produced tubing because of poor surface finish. Author (GRA)

N74-34900# George Washington Univ., Washington, D.C. Program in Logistics.
INFERENCE FROM ACCELERATED LIFE TESTS USING EYRING TYPE RE-PARAMETERIZATIONS
Nozer D. Singpurwalla, Victor F. Castellino, and Donald Y. Goldschen 16 Apr. 1974 18 p refs
(Contract N00014-67-A-0214-0001; F33615-74-C-4040; NR Proj. 347-020)
(AD-778641; Serial-T-299) Avail: NTIS CSCL 12/1

Least squares estimators of the parameters of the generalized Eyring Model are obtained using data from censored life tests conducted at several accelerated environments. These estimators are obtained after establishing that the Gauss-Markov conditions for least squares estimation are satisfied. Confidence intervals for the hazard rate at use conditions are obtained after empirically showing that the logarithm of the estimate of the hazard rate at use conditions is approximately normally distributed. The coverage probabilities of the confidence intervals are also verified by a Monte Carlo experiment. The techniques are illustrated by an application to some real data. Author (GRA)

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State.

N74-34901 Southern Methodist Univ., Dallas, Tex.
ELECTROMAGNETIC THEORY AND RADIATION CHARACTERISTICS OF HETEROSTRUCTURE INJECTION LASERS Ph.D. Thesis
Mahammad Javad Zoroofchi 1974 113 p
Avail: Univ. Microfilms Order No. 74-22656

The near- and far-field electromagnetic radiation of heterostructure injection lasers using a five layer slab model is discussed. An analysis of the electromagnetic modal gain functions for different cavity widths and different active region locations is made. The injection laser can operate in the fundamental mode when the active region is placed near the center of the cavity. A structure for a large-optical-cavity laser which produces a narrow single-beam radiation pattern is described and its near- and far-field radiation patterns are shown. The experimental results for two small-cavity double heterojunction lasers and an analysis of their far-field radiation patterns are presented. The index of refraction for n-type GaAs is calculated. It is shown that an important contribution to radiation confinement in the optical cavity in laser structures is the index-of-refraction change. Dissert. Abstr.

N74-34902 Rice Univ., Houston, Tex.
DIFFERENCE FREQUENCY GENERATION OF TUNABLE COHERENT RADIATION IN THE MID-INFRARED Ph.D. Thesis
Charles David Decker 1974 161 p
Avail: Univ. Microfilms Order No. 74-21262

High power, wavelength tunable coherent radiation in the mid-infrared spectral region is discussed. Difference frequency generation by optical mixing of two laser beams in a proustite crystal is investigated as an alternative to extant sources of tunable coherent infrared radiation. A narrow linewidth organic dye laser cavity was developed. The output of this was optically mixed with orthogonally polarized ruby laser radiation in a proustite crystal oriented at the appropriate phase matching angle to generate infrared radiation tunable from 3.20 - 6.47 mu. Optical mixing of the outputs of two dye lasers in proustite is investigated as an alternative to ruby - dye mixing. Wavelength tunability from 5.82 - 7.25 mu is achieved. Dual dye laser optical mixing had certain advantages over ruby - dye mixing in proustite. Computer analysis of the nonlinear optical processes show that momentum mismatch due to the finite spectral breadth of the mixing laser beams is the principal cause of less than optimum frequency conversion. Dissert. Abstr.

N74-34903 Arizona Univ., Tucson.
THEORY OF THREE-LEVEL AND MULTILEVEL-ANHARMONIC-OSCILLATOR LASER TRANSITIONS Ph.D. Thesis
Farzaneh Najmabadi 1974 122 p
Avail: Univ. Microfilms Order No. 74-21138

The theory of Lamb is extended to treat the three level cascade and competitive transitions in both homogeneously and inhomogeneously broadened laser media. The electromagnetic field is treated as a classical superposition of two modes, one for each transition. The atoms obey the laws of quantum mechanics, and the atom-field interaction energy is expanded in the electric-dipole approximation. Equations determining the amplitudes and frequencies of the modes are found with the use of the self consistency requirement that the electric field assumed to induce the polarization of the medium equals the field sustained by the resulting polarization. These equations are solved to third order in the perturbation energy. Graphs of intensities and coupling constants of steady-state intensities are obtained. Stability conditions for various physical solutions are discussed. Part 2 treats a multilevel anharmonic cascade laser which can be applied to diatomic systems. Dissert. Abstr.

N74-34904 California Univ., Los Angeles.
THE FREQUENCY SHIFT LASER BEAM DEFLECTOR Ph.D. Thesis
John Lee Wilkerson 1974 280 p
Avail: Univ. Microfilms Order No. 74-22967

The theoretical optimization and performance limits of a system for deflecting a mode locked laser beam are dealt with. Deflection is achieved by a frequency shift of the laser mode lock spectrum and a dispersion element which converts a frequency change into an angular change of the light path. The theoretical development emphasizes a maximization of the frequency shift with respect to various system parameters. Equations are derived which give the maximum frequency shift, the number of resolution spots for a beam scanner application and the distortion limits for the system. An experimental frequency shift beam deflector was constructed which utilized a mode locked long cavity Helium Neon laser source. The frequency shifting element was a lithium niobate crystal used as a transverse electro-optical phase modulator. A Fabry-Perot etalon was used as the dispersion element and the experimental results indicate this system could resolve about 45 laser spots. Dissert. Abstr.

N74-34905*# Stanford Univ., Calif. Inst. for Plasma Research.
INFRARED MASER EMISSION FROM INTERSTELLAR HYDROXYL MOLECULES
Robert Frank Pelzmann, Jr. Oct. 1974 134 p refs
(Grant NGR-05-020-510)
(NASA-CR-140180; SU-IPR-595) Avail: NTIS HC $9.75 CSCL 20E

The energy structure and transition rates of the OH radical were studied in rotational and vibrational energies to provide the basis for studies of the population distributions under various exciting mechanisms. The absorption of ultra-violet or near infrared radiation which might explain the microwave emission was examined, as well as the absorption of low temperature blackbody radiation and collisions with molecular hydrogen. The results of the population studies were applied to the transfer equation, and a model of a uniform spherical cloud of OH was used with the pumping process which occurs uniformly throughout the region. The emission is unsaturated and the intensity is an exponential function of the size of the cloud for high pumping rates, and the region of unsaturated emission shrinks for lower pumping rates until the entire region is saturated, the intensity then becoming a linear function of the size of the emitting cloud. Author

N74-34906*# Yale Univ., New Haven, Conn. Dept. of Physics.
INVESTIGATION OF THE BASIC FOUNDATIONS OF MASERS AND LASERS Final Report, 1 Jan. 1965 - 30 Jun. 1974
Willis E. Lamb, Jr. 30 Jun. 1974 17 p
(Grant NGR-07-004-035)
(NASA-CR-140512) Avail: NTIS HC $4.00 CSCL 20E

Research work on the theory of lasers and masers is reported. Special attention is given to technological applications of laser theory. Author

N74-34907# Sandia Labs., Albuquerque, N.Mex.
LASER-FUSION RESEARCH Progress Report, Jul. - Dec. 1973
Everet H. Beckner Sep. 1974 41 p refs
(Contract AT(29-1)-789)
(SAND74-0067) Avail: NTIS HC $5.25

The Sandia Laser Fusion Program objectives are: (1) to explore and develop the application of high-power laser and laser fusion phenomena to the simulation of nuclear weapon effects; (2) to conduct research and development activities pursuant to development of large, high-power lasers for future applications to laser fusion; and (3) to develop concepts for high-power lasers as direct weapon systems. Author

N74-34908# Defence Research Establishment Valcartier (Quebec).
TETRAFLUOROHYDRAZINE AS A SATURABLE ABSORBER OF CO2 LASER RADIATION
R. D. Suart Mar. 1974 22 p refs
(DREV-TN-2118/74) Avail: NTIS HC $4.25

Tetrafluorohydrazine (N2F4) was found to induce passive Q-switching in a continuous wave, CO2 laser oscillating on P

and R branch transitions of the 10.6 micron system. The gas was also observed to force the laser to oscillate on P, then, at higher pressures, R branch lines of the 9.3 micron system. Tetrafluorohydrazine shows some promise as an agent for the isolation of high energy CO2 amplifier sections. Author

N74-34909# Defence Research Establishment Valcartier (Quebec).
CAUSES OF POWER DEGRADATION IN A HIGH-REPETITION RATE TEA CO2 LASER
R. D. Suart, R. J. Levesque, and D. R. Snelling Mar. 1974 53 p refs
(DREV-R-709/74) Avail: NTIS HC $5.75

Output power, gas charge composition, and electrical discharge properties of the intermediate high repetition rate laser (intermediate HRRL) were measured. Factors, other than the normal progressive loss of CO2 due to electrical discharge, controlling the output power were investigated. The conversion of CO2 into CO and O2 is an important effect leading to power loss in the HRRL. Author

N74-34910# Defence Research Establishment Valcartier (Quebec).
APPLICATION OF DECONVOLUTION FILTERING TO IMPROVE THE RANGE RESOLUTION OF A LADAR TARGET IMAGING SYSTEM
J. F. Boulter Mar. 1974 24 p refs
(DREV-TN-2120/74) Avail: NTIS HC $4.25

A technique for deconvolving a system resolution function from noisy data according to a minimum error criterion was derived and implemented on a digital computer using a fast Fourier transform algorithm. The procedure was applied to data obtained from an experimental rangegated ladar target imaging system in order to: (1) improve the range resolution (ie. full width at half maximum of the range resolution function) from 16.6 meters to 5.5 meters; (2) to define the range origin to an accuracy of 1.5 meters; and (3) to perform subjective filtering in range for the purpose of either smoothing or enhancing high frequency detail. Author

N74-34911*# Aerospace Corp., Los Angeles, Calif. Electronics Research Lab.
PRECISION LASER RANGE FINDER SYSTEM DESIGN FOR ADVANCED TECHNOLOGY LABORATORY APPLICATIONS Final Report
K. E. Golden, R. L. Kohn, and D. H. Seib 23 Jul. 1974 119 p refs
(Contract NAS1-12727)
(NASA-CR-132532; ATR-74(7438)-1) Avail: NTIS HC $9.00 CSCL 20E

Preliminary system design of a pulsed precision ruby laser rangefinder system is presented which has a potential range resolution of 0.4 cm when atmospheric effects are negligible. The system being proposed for flight testing on the advanced technology laboratory (ATL) consists of a modelocked ruby laser transmitter, course and vernier rangefinder receivers, optical beacon retroreflector tracking system, and a network of ATL tracking retroreflectors. Performance calculations indicate that spacecraft to ground ranging accuracies of 1 to 2 cm are possible. Author

N74-34912# Sandia Labs., Albuquerque, N.Mex.
LASER-FUSION RESEARCH Progress Report, Jan. - Jun. 1973
1973 39 p refs
(Contract AT(29-1)-789)
(SLA-73-954) Avail: NTIS HC $5.00

Summaries of research during this period are given for the following: (1) glass laser systems, (2) laser-plasma interaction studies, (3) gas laser research, (4) chemical laser research, and (5) theory. NSA

N74-34913# Avco-Everett Research Lab., Everett, Mass.
LASER ATMOSPHERIC PROPAGATION KINETICS Final Technical Report, 1 May - 31 Dec. 1973
C. A. Brau, E. R. Bressel, and S. L. Glickler Jun. 1974 62 p refs
(Contract N00014-73-C-0311; ARPA Order 1806)
(AD-782416) Avail: NTIS CSCL 07/4

A model has been developed to describe the kinetics of absorption of DF and CO laser radiation by the atmosphere. DF laser radiation is absorbed by N2, CO2, N2O, CH4, HDO and H2O and the H2O continuum. CO laser radiation is absorbed by CO2 and H2O. The kinetics model describes the vibrational relaxation of these absorbing species in considerable detail. Preliminary results have been obtained for the absorption of CO and DF radiation under a variety of conditions. (Modified author abstract) GRA

N74-34914# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
OPTICAL MATERIALS CHARACTERIZATION Semiannual Technical Report, 1 Jan. - 30 Jun. 1974
Albert Feldman, Deane Horowitz, Roy M. Waxler, Irving Militson, and Marilyn J. Dodge Jul. 1974 21 p refs
(ARPA Order 2620; NBS Proj. 3130442)
(AD-782564; NBSIR-74-525) Avail: NTIS CSCL 20/5

A program has been established for measuring refractive index, stress-optical constants, ij, change of index with temperature, thermal expansion coefficient, and elastic compliances, ij, of infrared laser window materials. These parameters are necessary for determining the optical distortion that occurs in windows due to heating by the absorption of high power laser radiation. Materials currently under study are polycrystalline ZnSe, As2S3 glass, chalcogenide glass (Ge 33%, As 12%, Se 55%), and KCl. (Modified author abstract) GRA

N74-34915# Army Missile Command, Redstone Arsenal, Ala. Physical Sciences Directorate.
STUDY OF THE GAIN-DEPENDENT REFRACTIVE INDEX OF A CO2 LASER
Thomas E. Honeycutt Jun. 1974 151 p refs
(DA Proj. 1T6-62609-A-308)
(AD-782983; RR-74-4) Avail: NTIS CSCL 20/5

Results of research directed toward the achievement of a better understanding of the gain-dependent index of refraction of an active CO2 laser medium are presented. Experimentally discovered frequency jumping and gain discontinuity effects in a 3-mirror laser have been studied using a newly developed mathematical model in which it was assumed that there was present a gain-dependent portion of the refractive index of the laser medium. The analytical results are related to the experimental results obtained from a long, 3-mirror, frequency-modulated CO2 laser cavity. It was found that the simple model predicts, qualitatively, the experimental results. Specific results indicate that frequency pushing is the dominant interaction process in a reflective type coupled-cavity laser, and that this process is more dependent upon the direction in which the laser frequency is swept than it is upon the location of the pertinent mode frequencies relative to the line center frequency. (Modified author abstract) GRA

N74-34916# Physical Sciences, Inc., Wakefield, Mass.
AEROSOL PROPAGATION EFFECTS Mid Contract Report
G. E. Caledonia and K. L. Wray 1 Jun. 1974 28 p refs
(Contract N00014-74-C-0254)
(AD-782627; PSI-TR-6) Avail: NTIS CSCL 07/4

A model has been developed for the prediction of the time dependent properties of the gas surrounding a water droplet under irradiation by a high intensity laser beam. The basic phenomena included in the model are absorption, heating and vaporization in the droplet and convection, thermal conduction and diffusion in the gas. The model assumes volume absorption by the droplet, a constant pressure gas, and that the initial vapor velocity is much less than the local sound speed. The conditions under which these assumptions are appropriate have been identified. A number of preliminary calculations are presented. Author (GRA)

N74-34917# United Aircraft Corp., East Hartford, Conn.
AERODYNAMIC WINDOW PERFORMANCE AND OPTICAL QUALITY Interim Report
L. S. Cohen, E. A. Kush, R. N. Guile, and R. J. Flaherty Feb. 1974 78 p refs
(Contract F44620-73-C-0031; AF Proj. 9783)
(AD-783298; UARL-N911593-1; AFOSR-74-1283TR) Avail:

NTIS CSCL 20/4

The aerodynamic window is a viable means of exiting the high-power beam from a low-pressure laser cavity. It consists of a supersonic jet which spans an opening in the laser cavity wall sealing the cavity from ingestion of ambient air. The differential pressure force across the opening is balanced by a change in jet momentum while the beam passes through the aerodynamic window flow field transversely to the direction of flow of this jet. In evaluating the performance of the aerodynamic window the areas of primary concern are: (1) the ability of the aerodynamic window to transmit the laser beam with minimum beam degradation, (2) the amount of mass flow required to effect the aerodynamic seal, and (3) the effectiveness of the aerodynamic window in sealing the cavity from ingestion of ambient air. The technical investigation discussed herein is directed toward the first two areas of concern. GRA

N74-34918# Oklahoma State Univ., Stillwater. Dept. of Physics.

GROWTH AND HARDENING OF ALKALI HALIDES FOR USE IN INFRARED LASER WINDOWS Annual Report

William A. Sibley, Charles T. Butler, John R. Hopkins, and Joel J. Martin 20 Apr. 1974 31 p refs

(Contract F19628-72-C-0306; AF Proj. 2055)

(AD-783328; AFCRL-TR-74-0220; AR-2) Avail: NTIS CSCL 20/5

Several KCl crystals have been pulled from melts of reagent grade KCl, RAP treated reagent grade KCl, and HCl/Cl2 treated KCl. The OH(-) concentrations and the 10.6 micrometers optical absorption of these crystals were evaluated. The results indicate that both the RAP and HVl/Cl2 treatments effectively remove OH(-) and lower the 10.6 micrometers absorption. Radiation damage has been investigated as a supplementary mechanism for strengthening KCl-KBr alloys and polycrystalline KCl. The results show that the hardening due to the radiation damage is independent of the other mechanisms present. Hence, the total strength equals the radiation damage in the pure crystal plus the strength caused by either alloying or small grains. (Modified author abstract) GRA

N74-34919# University of Southern Calif., Los Angeles. Electronic Sciences Lab.

IR WINDOW STUDIES Quarterly Technical Report

Ferdinand Kroger and John H. Marburger 15 Dec. 1973 87 p refs

(Contract F19628-72-C-0275; ARPA Order 2055)

(AD-783331; USCEE-469; AFCRL-TR-74-0060; QTR-6) Avail: NTIS CSCL 20/5

The theory of thermal lensing is reviewed and presented in modified form. A method to determine the contributions of various processes to multiphonon absorption is proposed. For GaAs, the lowest 10.6 micrometers absorptions found have a weak temperature dependence corresponding to theoretical predictions for multiphonon absorption. Layers of GaAs up to 2mm thick have been made by chemical vapor transport. The layers had inclusions, however, and the high 10.6 micrometers absorption probably result from these. A method for oxygen detection in Te-doped GaAs-Te was developed. In GaAs-Si, an oxygen content below the Si content cannot be determined. Diffuse streaks in the diffraction pattern of GaAs are attributed to thermal diffuse scattering of electrons at acoustic phonons. KBr with a 10.6 micrometers absorption of .0011/cm has been grown. A TEA laser for damage studies is being assembled. (Modified author abstract) GRA

N74-34920# Washington Univ., Seattle. Aerospace Research Lab.

LASER HEATING FOR HIGH ENTHALPY FACILITIES Technical Interim Report, Aug. 1972 - Jul. 1973

Victor R. Buonadonna, Abraham Hertzberg, Harlow G. Ahlstrom, and George C. Vlases Apr. 1974 33 p refs

(Contract F33615-71-C-1914; AF Proj. 7065)

(AD-783208; ARL-74-0029) Avail: NTIS CSCL 14/2

Following a preliminary analytical feasibility study concerning the addition of stagnation enthalpy to the air flow of a hypersonic wind tunnel by volume addition to energy using a high power carbon dioxide laser, extension and continuation of these studies were carried out. In particular, further analytical studies were completed to determine the unsteady effects that may occur in such a facility, the nature of the heat transfer losses, and the nature of the flow quality. This interim report also describes the development of a high power carbon dioxide laser and high pressure test cell that will be used to perform the experiments required to establish the nature of the interaction of 10.6 micrometer laser radiation at very high pressures.

Author (GRA)

N74-34921# Arizona Univ., Tucson. Optical Sciences Center.

SURFACE SCATTER STUDY Final Report, Mar. 1972 - Jan. 1973

Roland V. Shack and Michael A. DeBell Feb. 1974 76 p refs

(Contract F07401-72-C-0181)

(AD-782489; SAMSO-TR-74-88) Avail: NTIS CSCL 20/6

The angular spectrum of plane waves approach to scalar diffraction theory has been extended to include scattering. An instrument was designed and constructed to measure scattered light distributions from aluminized glass surfaces. Diffuse reflectance measurements were made on samples having varying degrees of surface finish. Results of these measurements as a function of angle of incidence and wavelength are reported. Author (GRA)

N74-34922# Oregon Graduate Center for Study and Research, Beaverton.

PROPAGATION OF MULTIWAVELENGTH LASER RADIATION THROUGH ATMOSPHERIC TURBULENCE Interim Technical Report, 1 Dec. 1973 - 30 Apr. 1974

J. Richard Kerr and James R. Dunphy 31 May 1974 84 p refs

(Contract F30602-74-C-0082; ARPA Order 1279)

(AD-783277; RADC-TR-74-183; Rept-1103-2) Avail: NTIS CSCL 20/6

The effects of atmospheric turbulence on target irradiance using a nearfield, wander-tracking laser transmitter have been investigated in detail. A unified analytical and phenomenological treatment of the mean irradiance and its fluctuations is presented, with supporting experimental data. The advantages to be gained through the use of wander cancellation are seen to be substantial, and in many cases larger than predicted by the basic theory. A brief description is also given of the investigation of the short-term statistics of turbulence and scintillations. Theoretical and experimental results have been obtained for the prediction of confidence intervals or data spread in such measurements, and the effects of averaging times. In addition, a computer simulation technique has been formulated for the generation of an ensemble of instantaneous, short propagation paths through turbulence. Author (GRA)

N74-34923# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ESTIMATE OF THE CHARACTERISTICS OF A GAS-DYNAMIC LASER

N. A. Genaralov, G. I. Kozlov, and I. K. Selezneva 24 Jun. 1974 18 p refs Transl. into ENGLISH from Zh. Prikl. Mekh. Tekh. Fiz. (USSR), no. 5, 1972 p 33-40

(AD-783445; FTD-HT-23-696-74) Avail: NTIS CSCL 20/5

The report calculates the characteristics of a gas-dynamic laser in a mixture of CO2-N2-He with a flat resonator. The system of equations describing the processes inside the resonator is analyzed and solved numerically. Inverse population of CO2 laser levels is caused by the preliminary expansion of the given mixture through a flat hyperbolic nozzle. The dependences of output power on the coefficients of mirror reflection, resonator length, pressure, and composition of the working gas mixture are obtained. GRA

N74-34924# Illinois Univ., Urbana. Dept. of Electrical Engineering.

FAR INFRARED OPTICAL ELECTRONICS AND LASER RADIATION MODULATION Annual Report, 1 Feb. 1973 - 31 Jan. 1974

Paul D. Coleman 1 Mar. 1974 81 p refs

(Grant AF-AFOSR-1981-71; AF Proj. 9751)

(AD-783179; UILU-ENG-74-2543; AFOSR-74-0744TR) Avail: NTIS CSCL 20/5

The report describes research done on far IR integrated optics and frequency tunable coherent sources. The integrated optics studies are being performed in crystalline quartz dielectric waveguides using a CW optically pumped CH3F molecular laser operating at 496 micrometers. Particular problems being studied at this time are waveguide couplers and the characteristics of single mode operation. Discrete frequency tuning in the 70-5,000 micrometer range is being obtained by mixing selected CO2 laser lines in a GaAs dielectric waveguide. A second frequency tunable source using a simultaneous Raman and infrared active mode in GaAs is being studied to generate multi-kilowatt tunable power in the 11-12 micrometer range and 1-10 watt power in the 10-400 micrometer region. (Modified author abstract) GRA

N74-34925# Naval Postgraduate School, Monterey, Calif.
A TECHNOLOGICAL FORECAST FOR GALLIUM ARSENIDE LASERS M.S. Thesis
Harold Muschott Olson Jun. 1974 160 p refs
(AD-783669) Avail: NTIS CSCL 20/5

A technological forecast for GaAs injection lasers operating at room temperature is made. It indicates significant technological progress followed by widespread use for optical waveguide communications in the early 1980's. Extrapolated values for power, efficiency, lifetime, threshold current, and cost per watt are tabulated for the years 1976 and 1980. Two trend extrapolation techniques based on the different assumptions that technological progress advances exponentially with time and that technological progress advances exponentially with cumulative production are compared. The technological progress function which uses patent output as a measure of cumulative production is determined to be the best measure in the case of the injection laser. Author (GRA)

N74-34926# United Aircraft Corp., East Hartford, Conn. Research Labs.
RESEARCH ON HCl CHEMICAL LASER Letter Report, 15 Apr. - 15 Jul. 1974
R. J. Hall, R. A. Meinzer, and R. V. Steele 25 Jul. 1974 5 p
(Contract N00014-74-C-0377)
(AD-783706) Avail: NTIS CSCL 20/5

Research efforts and results are summarized for an investigation whose objectives are to characterize the reaction mechanism of the cw combustion-driven chain-reaction HCl laser, select an optimum set of operating conditions, demonstrate the magnitude of the specific power which can be experimentally achieved, and predict the performance potential of the HCl laser at high cavity static pressures. These objectives are being pursued by making analytical calculations and experimental measurements. A computer program, CHEMIX, is being used to model the performance of the chain-reaction laser and the validity of these computations is being investigated by making comparisons with the results of chemiluminescent emission spectroscopy and optical power measurements. GRA

N74-34927# Naval Research Lab., Washington, D.C.
OPTICAL ISOLATION AND THE DESIGN OF LARGE APERTURE, HIGH EXTINCTION RATIO FARADAY ROTATORS FOR HIGH POWER GLASS LASERS Final Report
O. C. Barr Jun. 1974 67 p refs
(NRL Proj. 65H02-29)
(AD-783514; NRL-MR-2817) Avail: NTIS CSCL 20/5

A simple, high performance, low cost Faraday rotator of 8 cm aperture and 36 dB isolation has been designed and constructed. Two of these rotators have been incorporated into the high power glass laser at the U.S. Naval Research Laboratory (NRL). Design considerations, construction details, and system integration aspects are discussed. Author (GRA)

N74-34928# Maryland Univ., College Park. Dept. of Electrical Engineering.
INVESTIGATION OF THE LONG TERM FREQUENCY STABILITY OF STABLE LASER STRUCTURES Final Report
U. E. Hochuli, P. Haldemann, and H. A. Li Aug. 1974 23 p refs
(Contract N00014-67-A-0239-0016; NR Proj. 375-541)
(AD-783711) Avail: NTIS CSCL 20/5

The 6328A He-Ne laser structures, made from ultra low expansion materials, suspended in temperature and pressure controlled chambers, have shown drift rates in excess of 5 MHz per day. The same structure, evacuated and used as passive Fabry Perot resonators, suspended in the previous now evacuated chambers, still show a drift rate of the order of -2 MHz per day. Computer simulated mirror model ageing shows that relatively large changes of the dielectric constants of the mirror coatings are needed to explain the measured drift. The authors propose that the dimensional stability of the materials, the properties of the optical contacts used as well as the behavior of the dielectric mirrors should be more carefully investigated. (Modified author abstract) GRA

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N74-34929 British Library Lending Div., Boston Spa (England).
ADVANCES IN THE EXTRACTIVE METALLURGY OF COPPER, LEAD AND ZINC
C. C. Banks and A. W. Fletcher 3 Dec. 1973 36 p refs
Prepared by Warren Spring Lab.
(BLL-LR-192(ME)-(7628.85)) Avail: British Library Lending Div., Boston Spa, Engl.

Recent innovations in the extraction of copper, lead and zinc from primary sources are reviewed. Processes based on both pyro- and hydro-metallurgical principles are discussed, and the acceptability of these processes on environmental pollution ground is considered. In addition the technology of the individual processes is exmained and where possible, capital and operating costs are given. Author

N74-34930 Central Electricity Generating Board, London (England). Information Services.
STRESS CORROSION CRACKING OF FERRITIC STAINLESS STEELS: A SELECTIVE BIBLIOGRAPHY, 1965 - 1974
P. G. Williams, comp. Oct. 1974 7 p refs
(CE-Bib-240) Avail: Issuing Activity

A study was made of stress-hydrogen cracking problems for type 410 stainless steel. Results show general correlation exists between resistance to stress hydrogen cracking and notch sensitivity, However, considerable variability in behavior is possible in apparently similar materials and direct conversion of impact data to stress-hydrogen cracking susceptibility is not reliable. Thermal treatments which increase fracture toughness also increase resistance to stress-hydrogen cracking. High purity vacuum melted alloys have much higher resistance to stress hydrogen cracking than commercial air-melted alloys. Specific ingredients responsible for such degradation are not known, but general steel making alloy additions may contribute in part. Author

N74-34931 Connecticut Univ., Storrs.
THE EFFECT OF ORIENTATION AND CHEMISTRY ON CREEP IN A Ni-BASE SUPERALLOY Ph.D. Thesis
Mohammad Khobaib 1974 124 p
Avail: Univ. Microfilms Order No. 74-21791

A systematic study has been made of the basic deformation processes occurring during high temperature deformation in Ni-base superalloy, Udimet-700. Major attention has been devoted to the precise orientation dependence of creep and yielding in single crystals with 111, 110 and 100 axes. All tests were conducted on compressive specimens in the temperature range 1400-2000 F. Both the flow stress and the creep properties were found to be strongly orientation dependent. Crystals with 111 axis had the maximum creep resistance and this is attributed to a low critical resolved shear stress for octahedral slip. A significant feature, hitherto unobserved in this class of materials, was that 110 axis crystals had a substantially higher creep strength than crystals with a 100 axis. Microtwinning during creep has been observed in 100 axis crystals. The existence of microtwins in crystals of this orientation is significant, since it has been

postulated that microtwins can only occur in crystal oriented for single slip. Dissert. Abstr.

N74-34932*# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
AVOIDANCE OF STRESS CORROSION SUSCEPTIBILITY IN HIGH STRENGTH ALUMINUM ALLOYS BY CONTROL OF GRAIN BOUNDARY ANP MATRIX MICROSTRUCTURE
Final Report, 14 Feb. - 13 Sep. 1973
Philip Adler and Richard Delasi Jan. 1974 69 p refs
(Contract NAS8-28986)
(NASA-CR-120468; RE-468) Avail: NTIS HC $6.50 CSCL 11F

The relation of microstructure to the mechanical strength and stress corrosion resistance of highest strength and overaged tempers of BAR and 7050 aluminum alloys was investigated. Comparison is made with previously studied 7075 aluminum alloy. Optical microscopy, transmission electron microscopy, and differential scanning calorimetry were used to characterize the grain morphology, matrix microstructure, and grain boundary microstructure of these tempers. Grain boundary interparticle spacing was significant to stress corrosion crack propagation for all three alloys; increasing interparticle spacing led to increased resistance to crack propagation. In addition, the fire grain size in Bar and 7050 appears to enhance crack propagation. The highest strength temper of 7050 has a comparatively high resistance to crack initiation. Overall stress corrosion behavior is dependent on environment pH, and evaluation over a range of pH is recommended. Author

N74-34933*# Scientific Translation Service, Santa Barbara, Calif.
INFLUENCE OF MOLYBDENUM ON RESISTANCE TO CORROSION BY PITTING AND CONTACT OF AUSTENITIC STAINLESS STEELS
R. J. Brigham Washington NASA Oct. 1974 22 p refs Transl. into ENGLISH from Mater. et Tech. (France), v. 62, Mar. 1974 p 127-136
(Contract NASw-2483)
(NASA-TT-F-15951) Avail: NTIS HC $4.25 CSCL 11F

The resistance to corrosion by pitting and by contact in solutions of hydrochloric acids of a number of austenitic stainless steels containing 7.5% molybdenum has been evaluated by using the temperature as a criterion. For corrosion by pitting, a critical pitting temperature (CPT) has been defined as being the temperature above which corrosion by pitting takes place and below which the steel is not attached. The effects of variations in the concentration of chloride and of the small changes in concentration of secondary additive elements (Mn, N, Si, Cu) have been measured. The alloys have been quantitatively classified in relation to their resistance to corrosion by pitting. As an example, resistance to corrosion by contact was measured, and a determination corrosion by contact (TCC) was made. Tests have shown that the addition of molybdenum considerably reduces the tendency to corrosion by contact, while the effects of the secondary additive elements are considerably less. Author

N74-34934*# Scientific Translation Service, Santa Barbara, Calif.
A MECHANISTIC STUDY OF THE EFFECT OF MOLYBDENUM ADDITIONS ON THE CORROSION RESISTANCE OF AUSTENITIC STAINLESS STEELS
J. M. Defranoux Washington NASA Oct. 1974 25 p refs Transl. into ENGLISH from Mater. et Tech. (France), v. 62, Mar. 1974 p 137-145
(Contract NASw-2483)
(NASA-TT-F-15950) Avail: NTIS HC $4.50 CSCL 11F

The addition of molybdenum does not seem to modify the static properties of the passive film: the ionic conductivity of the film and the quantity of electricity necessary to destroy it cathodically do not seem to depend on the molybdenum content of the alloy. It is also known to be the same with electrical conductivity as expressed by the kinetics of oxygen reduction. In acid, addition of molybdenum confers on austenitic stainless steels a greater ease of passivation by increasing the anodic polariability in the active state and by accelerating the kinetics of passive film formation. This second factor likewise confers greater resistance to depassivation for molybdenum bearing steels, at least for cathodic effects which are not too intense. The mechanism of the beneficial effect of molybdenum on resistance to pitting corrosion is much more difficult to analyze. Author

N74-34935*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE EFFECT OF HEAT TREATMENT AND TEST PARAMETERS ON THE AQUEOUS STRESS CORROSION CRACKING OF D6AC STEEL
William P. Gilbreath and Michael J. Adamson Sep. 1974 28 p refs
(NASA-TM-X-62377) Avail: NTIS HC $4.50 CSCL 11F

The crack growth behavior of D6AC steel as a function of stress intensity, stress and corrosion history and test technique, under sustained load in natural seawater, 3.3 percent NaCl solution, distilled water, and high humidity air was investigated. Reported investigations of D6AC were considered with emphasis on thermal treatment, specimen configuration, fracture toughness, crack-growth rates, initiation period, threshold, and the extension of corrosion fatigue data to sustained load conditions. Stress history effects were found to be most important in that they controlled incubation period, initial crack growth rates, and apparent threshold. Author

N74-34936*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PREPARATION OF THICK MOLYBDENUM TARGETS
Jag J. Singh Oct. 1974 18 p refs
(NASA-TM-X-72014) Avail: NTIS HC $3.00 CSCL 11F

Thick natural molybdenum deposits on nickel plated copper substrates were prepared by thermal decomposition of molybdenum hexacarbonyl vapors on a heated surface in an inert gas atmosphere. The molybdenum metal atoms are firmly bonded to the substrate atoms, thus providing an excellent thermal contact across the junction. Molybdenum targets thus prepared should be useful for internal bombardment in a cyclotron where thermal energy inputs can exceed 10 kW. Author

N74-34937# Bureau of Mines, Albany, Oreg. Metallurgy Research Center.
SOURCE AND CONTROL OF NITRIDE INCLUSIONS IN TITANIUM
Jack L. Henry, S. D. Hill, W. E. Anable, and J. L. Schaller 1974 54 p refs
(BM-RI-7933) Avail: NTIS HC $5.75

A laboratory and a pilot-plant-scale investigation has been conducted to examine possible sources of nitride defects in the production of magnesium-reduced titanium sponge. The production of alpha-stabilized nitride inclusions in hot-rolled titanium plated from air contamination of sponge during its manufacture has been experimentally demonstrated. Magnesium-reduced sponge prepared from air-contaminated magnesium or when contaminated by an air leak during reduction, vacuum distillation, or inert gas sweep, shows very large variations in nitrogen content. The highest incidence of inclusions resulted from sponge that was reduced by air-contaminated magnesium and from sponge subjected to air contamination during the vacuum distillation cycle and during helium sweep. Air contamination of sponge during the reduction cycle was not nearly as effective in producing inclusions. Maintenance of good vacuum-tight integrity, filtration of molten magnesium prior to charging into the reduction retort, and mechanical attrition of sponge to pulverize and disperse nitrides are suggested as practices to lower inclusion incidence in commercial titanium ingots. Author

N74-34938# Bureau of Mines, Albany, Oreg. Metallurgy Research Center.
PHASES AND INTERDIFFUSION BETWEEN TITANIUM AND ITS MONONITRIDE
Floyd W. Wood, P. A. Romans, R. A. McCune, and O. G. Paasche (Oregon State Univ.) 1974 45 p refs
(BM-RI-7943) Avail: NTIS HC $5.25

Phases formed by diffusion reactions between titanium and titanide nitride in the Ti-TiN system were studied. Reaction couples were prepared by embedding pockets of TiN powder in arc-melted buttons of titanium. Specimens were vacuum annealed at nominal temperatures of 800, 950, 1200, and 1500 C. Metallographically mounted cross sections from reacted annealed specimens and from some that were not annealed specimens

were examined optically. Each annealed specimen contained a segregated core primarily of delta-phase material, and epsilon phase diffusion layer, an alpha phase diffusion layer, and host metal. A new phase diagram is proposed. Diffusion behavior is also analyzed and diffusion coefficients are calculated. Author

N74-34939*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STRESS-RUPTURE STRENGTH AND MICROSTRUCTURAL STABILITY OF TUNGSTEN-HAFNIUM-CARBON-WIRE REINFORCED SUPERALLOY COMPOSITES
Donald W. Petrasek and Robert A. Signorelli Washington Oct. 1974 39 p refs
(NASA-TN-D-7773; E-7931) Avail: NTIS HC $3.25 CSCL 11F

Tungsten-hafnium-carbon - superalloy composites were found to be potentially useful for turbine blade applications on the basis of stress-rupture strength. The 100- and 1000-hr rupture strengths calculated for 70 vol. % fiber composites based on test data at 1090C (2000F) were 420 and 280 MN/m2 (61,000 and 41,000 psi, respectively). The investigation indicated that, with better quality fibers, composites having 100- and 1000-hr rupture strengths of 570 and 370 MN/m2 (82,000 and 54,000 psi, respectively), may be obtained. Metallographic studies indicated sufficient fiber-matrix compatibility for 1000 hr or more at 1090C (2000F). Author

N74-34940# Aeronautical Research Labs., Melbourne (Australia).
THE ROLL OF ATOMIC HYDROGEN IN THE STRESS CORROSION CRACKING OF TWO ULTRA-HIGH STRENGTH STEELS IN GASEOUS ENVIRONMENTS
W. J. Pollock Mar. 1974 22 p refs
(ARL/Met-Note-102) Avail: NTIS HC $4.25

Stress-corrosion cracking of ultra-high strength SD19 and D6AC steels was monitored in hydrogen, aerated distilled water, water vapor and mixtures of water vapor with oxygen and air. The predominant fracture modes (K/K sub ic approximately 0.8) in hydrogen, water-vapor/oxygen, and pure water vapor were intergranular, transgranular microvoid coalescence, and mixed mode respectively. Microvoid coalescence at the crack tip occurs when limited supplies of atomic hydrogen are generated, and intergranular cracking occurs at high rates of supply. Also, both grain-boundary and interstitial trans-crystalline diffusion of atomic hydrogen are modes of transport which explain the fracture modes observed in each environment. It is concluded that (1) atomic hydrogen causes decohesion of carbide-matrix interfaces to initiate microvoids in the plastic zone ahead of the crack which increases the plastic strain in the region of maximum triaxial stress such that microvoid coalescence can proceed and (2) brittle intergranular cracking can result from atomic decohesion and/or decohesion at carbide-matrix interfaces by atomic hydrogen located at grain boundaries. Author

N74-34941*# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
SPECIMEN ANALYSIS OF SKYLAB, M553 EXPERIMENT, FLIGHT SPECIMENS, PHASE C. Final Report
D. J. Larson, Jr. Aug. 1974 81 p refs
(Contract NAS8-28728)
(NASA-CR-120508; RE-486) Avail: NTIS HC $7.25 CSCL 11F

Skylab 2 flight samples were analyzed to study containerless solidification and the effects of weightlessness on the process. A record of solute redistribution processes and of solidification terracing is reported. The solute redistribution process was highly localized, and low index, crystallographic system were suggested. Samples demonstrated that under reduced pressure and gravity conditions the anticipated solid/liquid solidification process was perturbed and superseded by solid/liquid/gas reactions during melting and solidification. Author

N74-34942# TRW, Inc., Cleveland, Ohio.
POWDER METALLURGY SUPERALLOYS FOR GAS TURBINE ENGINES Final Report, 2 Jan. 1973 - 2 Jun. 1974
Charles S. Kortovich Jun. 1974 75 p refs
(Contract N00019-73-C-0138)
(AD-782625; TRW-ER-7743) Avail: NTIS CSCL 11/6

A program was conducted to develop powder metallurgy techniques for the optimization of alloys for gas turbine blades. A unique process was used consisting of blending metastable carbides and Y2O3 with carbon free base alloy MAR-M-246 by attrition and consolidating this blend by hot extrusion. This was followed by heat treatments designed to solution the metastable carbides and to grow either a minimum ASTM No. 2-3 grain size or a columnar grain size followed by precipitation of discrete particle grain boundary carbides during aging heat treatments. Mechanical property results indicated that while the 1400F tensile properties of the powder metallurgy alloys developed in the program were comparable to those for cast MAR-M-246, the 1900F/15 ksi stress rupture properties were substantially below those for the cast alloy. Hot corrosion results indicated that while the poor resistance of base alloy MAR-M-246 was improved by the addition of Y2O3 dispersoid, its resistance was still not comparable to other cast nickel-base superalloys. (Modified author abstract) GRA

N74-34943# Brown Univ., Providence, R.I. Dept. of Engineering.
THE INFLUENCE OF ANNEALING TEMPERATURE ON THE STRAIN RATE SENSITIVITY OF COPPER IN TORSION
P. E. Senseny, M. H. Richman, and J. Duffy May 1974 37 p refs
(Grant DA-ARO(D)-31-224-G182)
(AD-782197; ARO-D-G182/8) Avail: NTIS CSCL 11/6

The effect of annealing temperature on the high strain rate behavior of OFHC copper and a tellurium doped free machining copper is investigated. The annealing temperatures studied include temperatures above and below as well as the recrystalization temperature. The torsional split Hopkinson bar is utilized to achieve shear strain rates up to 2,000/s with a rise time of ten microseconds. The resulting stress-strain curves are compared with those obtained at a strain rate of .0001/s. Specimens of OFHC copper are subjected to incremental strain rate tests so that the change in flow stress corresponding to an increase in strain rate can be evaluated for each specimen. It is concluded that the strain rate sensitivity is positive in nature for each temperature and that its magnitude depends on the annealing temperature. Author (GRA)

N74-34944# Naval Research Lab., Washington, D.C.
FATIGUE RESISTANCE OF TYPE 348 STAINLESS STEEL UNDER SIMULATED WATER REACTOR CONDITIONS Final Report
Hugh H. Smith and Paul Shahinian 26 Jun. 1974 16 p refs (rr02211)
(AD-782516; NRL-7770) Avail: NTIS CSCL 11/6

The effects of neutron irradiation and high-temperature water-vapor environment on the fatigue behavior of Type 348 stainless steel were investigated. The tests were conducted in reverse bending at a constant amplitude of vibration in dry air, in water vapor, and in vacuum. Tests in water vapor were designed to simulate water-cooled reactor environments. Notched specimens were cycled at resonance, and crack-growth rates were determined by a method that relates changes in the frequency of vibration to crack growth. The general improvement in fatigue life for the irradiated condition was attributed mainly to decreased crack-growth rates. The fatigue life of this steel, when unirradiated, was longest in vacuum, was less in water vapor, and was least in air. The results of this study indicate that the fatigue performance of reactor components made of Type 348 stainless steel should not be adversely affected by the environment found in water-cooled reactors. (Modified author abstract) GRA

N74-34945# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROTECTION OF HIGH MELTING METALS AND ALLOYS FROM DIFFUSION SETTING WITH HIGH TEMPERATURES AND LOADS
A. L. Burykina and B. G. Gubenko 24 Jun. 1974 15 p refs Transl. into ENGLISH from Zashchitn. Pokrytiya na Metallakh (USSR), no. 6, 1972 p 180-184
(FTD Proj. T74-01-43; FTD Proj. T74-04-011)
(AD-782534; FTD-MT-24-1343-74) Avail: NTIS CSCL 11/6

This article investigates the adhesive interaction of certain alloys of high-melting metals (molybdenum, niobium and tantalum) in a neutral medium in a temperature range of 1300-1500C

under a 5 kgf/sq mm load both in the initial state and after the application of protective coatings. Specific materials were carbides, borides and nitrides. GRA

N74-34946# Cincinnati Univ., Ohio. Dept. of Materials Science and Metallurgical Engineering.
THE DEVELOPMENT OF HEAT-RESISTANT TITANIUM ALLOYS Technical Report, May 1969 - Oct. 1973
Michael Hoch, Naresh C. Birla, and S. A. Cole Dec. 1973 63 p refs
(Contract F33615-69-C-1529)
(AD-778462/2; AFML-TR-73-297) Avail: NTIS HC$3.75 CSCL 11/6

A classification for heat resistant titanium alloys was developed and possible new approaches for synthesizing new high temperature alloys were elucidated. X-ray diffraction techniques were used to determine the strain in the alpha phase of Ti-Al-Ga alloys associated with the alpha sub 2-phase caused by the addition of Al and/or Ga. An attempt was made to determine the phase boundary between alpha and (alpha + alpha sub 2) in the Ti-Al-Ga ternary system. The thermodynamic properties of titanium-aluminum, titanium-gallium, titanium-tin and titanium-aluminum-gallium were investigated. Thermodynamic activity measurements and binary interaction parameters were obtained. Author (GRA)

N74-34947# Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy and Materials Science.
A STUDY OF THE HEAT AND FLUID FLOW IN ELECTRO-SLAG REMELTING Final Report, 1 Dec. 1972 - 31 Jan. 1974
M. Basaran, R. Mehrabian, T. Z. Kattamis, and M. C. Flemings Apr. 1974 156 p refs
(Contract DAAG46-73-C-0088; DA Proj 1T0-62105-A-328)
(AD-782228; AMMRC-CTR-74-36) Avail: NTIS CSCL 11/6

A laboratory mold and experimental procedure were developed for unidirectional solidification of AISI 4340 low alloy steel by Electroslag Remelting (ESR). Major emphasis was to control solidification structure by developing methods to control and study factors affecting the important thermal variables. The effect of power input, current density, slag depth, and electrode diameter on electrode melting rate, temperature gradient in the liquid, G (sub L), and isotherm velocities, R, were studied and related to structure. Electrode and slag cooling were employed to enable achieving increased G (sub L)/R. Electrode melting rate is the main parameter affecting the important thermal variables. The structure of the ingots was found to be compatible with thermal measurements. Finally, a computer heat flow model was developed to predict metal pool shape and depth, and other important thermal variables for different operating conditions. (Modified author abstract) GRA

N74-34948# Pennsylvania Univ., Philadelphia. Dept. of Metallurgy and Materials Science.
PLASTICITY, RECOVERY AND CRYSTALLIZATION IN METALS Final Report
Robert Maddin 11 Jul. 1974 9 p refs
(Contract N00014-67-A-0216-0019)
(AD-781977) Avail: NTIS CSCL 11/6

This report presents papers on metal mechanical properties resulting from research sponsored by the Office of Naval Research at the University of Pennsylvania. GRA

N74-34949# Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy and Materials Science.
MACHINE CASTING OF FERROUS ALLOYS Interim Report, 1 Jan. - 30 Dec. 1973
Merton C. Flemings Apr. 1974 149 p refs
(Contract DAAG46-73-C-0110)
(AD-782247; AMMRC-CTR-74-27) Avail: NTIS CSCL 11/6

Low temperature alloys were used as model systems for ferrous alloys. Emphasis was on development and testing of innovative concepts that might lead to machine cast ferrous alloys of high quality and at lower costs. In initial phases of the program, copper base alloys and cast iron alloys were prepared with special nondendritic rheocast structure by batch processing. Compatibility studies were carried out to select materials suitable for preparing cast iron with the rheocast structure. Design principles were tested in a low temperature unit, used for casting Sn-15 %PB alloy. Two different types of casting machines were developed and successfully tested in combination with this continuous slurry producer. (Modified author abstract) GRA

N74-34950# Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy and Materials Science.
RELATIONSHIP OF COMPOSITION AND STRUCTURE TO STRENGTH IN TITANIUM ALLOYS Final Report, 1 May 1969 - 28 Feb. 1972
John F. Breedis May 1974 116 p refs
(Contract F33615-69-C-1603; AF Proj. 7351)
(AD-783288; AFML-TR-73-77) Avail: NTIS CSCL 11/6

The strengthening of beta-phase alloys by precipitation, alloying with an interstitial solute and grain refinement have been examined. Also considered in this work are the factors which influence the transition from slip to mechanical twinning as the dominant deformation mode. With regard to precipitation strengthening, omega-phase formation was examined in titanium-vanadium and the possibility of spinoidal decomposition was studied in ternary titanium-niobium-metal alloys. With regard to the influence of interstitial solute and grain refinement on mechanical properties, the influence of oxygen, at three levels of oxygen equivalent, was studied in titanium-18 atom percent molybdenum-oxygen alloys. Grain sizes were also varied by an order of magnitude to examine the Hall-Petch relationship. (Modified author abstract) GRA

N74-34951# Sherritt Gordon Mines, Ltd., Fort Saskatchewan (Alberta).
IMPROVEMENT IN THE MECHANICAL PROPERTIES AND OXIDATION RESISTANCE OF DISPERSION STRENGTHENED NICKEL-CHROMIUM ALLOYS Final Report, 1 Feb. 1972 - 30 Apr. 1973
D. H. Timbres and L. F. Norris Mar. 1974 67 p refs
(Contract F33715-72-C-1345; AF Proj. 7351)
(AD-783324; AFML-TR-74-8) Avail: NTIS CSCL 11/6

A dispersion strengthened nickel-base alloy, Ni/16Cr/5Al/2ThO2, exhibiting excellent high temperature oxidation resistance was subjected to a series of thermomechanical processing studies to optimize its mechanical properties. All properties with the exception of room temperature ductility were above the target specifications for the program. Extensive oxidation tests were conducted on an alternative composition, Ni/9Cr/6Al, with and without a dispersoid (ThO2) addition. The results indicated that the Ni/9Cr/6Al/2ThO2 alloy had generally poorer high temperature oxidation characteristics. The mechanical properties, however, were found to be similar to those of the Ni/16Cr/5Al/2ThO2 alloy. (Modified author abstract) GRA

N74-34952# Franklin Inst., Philadelphia, Pa. Research Labs.
CHARACTERIZATION OF CARBURIZED VASCO X-2 STEEL Final Report
L. Leonard and A. Pattnaik Jun. 1974 11 p
(Contract DAAJ01-73-C-0581)
(AD-782362; FIRL-C3678-01) Avail: NTIS CSCL 11/6

The metallurgical characteristics of samples of carburized Vasco X-2 steel (Boeing Materials Specification 7-223) are described. Based upon the expected combination of properties, namely, a high surface hardness for resistance to gear tooth surface deterioration and a softer core for toughness and resistance to crack propagation, this material has been designated for use in the transmission gearing of the heavy lift helicopter. Hardness testing and standard light microscope metallographic analysis was conducted on the case and core. In addition, a transmission electron microscopy study was performed to determine whether an intergranular carbide films were present in the case since such films could seriously impair the mechanical properties. GRA

N74-34953# Army Materials and Mechanics Research Center, Watertown, Mass.
FATIGUE CRACK GROWTH IN DUAL-HARDNESS STEEL ARMOR Final Report
Eric B. Kula, Albert A. Anctil, and Herbert H. Johnson Apr. 1974 26 p refs
(DA Proj. 1T0-62105-A-328)
(AD-782946; AMMRC-TR-74-6) Avail: NTIS CSCL 11/6

Dual-hardness steel (DHS) is a roll-bonded composite that has particularly attractive properties as an armor material. The present report is restricted to the specific problem of the behavior of through cracks in DHS under fatigue-type loading conditions. These are cracks that might arise as a result of manufacturing defects, near welds, at stress concentrations such as bolt holes, or as a result of projectile damage during ballistic impact. In such a case, the important questions are how fast is the crack growing and what is the residual life of the component under a typical operating load spectrum. Crack growth behavior of several lots of DHS is described in terms of several variables including stress level, test temperature, frequency, and crack propagation direction. In addition, attempts are made to analyze the crack growth behavior in terms of the properties of the two elements of which the composite is comprised. GRA

N74-34954# Rockwell International Corp., Thousand Oaks, Calif. Science Center.
THE MICROSTRUCTURE OF TITANIUM ALLOYS AS INFLUENCED BY THIN-FOIL ARTIFACTS
R. A. Spurling, C. G. Rhodes, and J. C. Williams 1974 17 p refs
(Contract N00014-71-C-0363; NR Proj. 031-752)
(AD-782596; SCPP-74-31) Avail: NTIS CSCL 11/6

The occurrence of a variety of thin foil artifacts which form during preparation of electron microscope thin foils from Ti alloys have been described in the literature. These artifacts severely complicate the study of phase transformations and microstructure/property relations in Ti alloys. This paper illustrates several examples of such artifacts which occur in a wide range of alloys and show how their presence can be bothersome and, in some instances, grossly misleading. Examples include spontaneous relaxation in beta-phase alloys, reversion of martensite and modification of omega-phase precipitates. An ion-thinning technique has been developed which suppresses the occurrence of thin foil artifacts, thereby permitting examination of alloys and microstructures which previously have not been analyzed. The structures of ion-thinned samples are illustrated and compared to the structures observed in conventionally thinned samples. Author (GRA)

N74-34955# Martin Marietta Aerospace, Denver, Colo.
THE INFLUENCE OF ENVIRONMENT ON CRACK BEHAVIOR Interim Report
I. R. Kramer Apr. 1974 22 p refs
(Contract F44620-74-C-0032; AF Proj. 9782)
(AD-783337; MCR-74-143; AFOSR-74-1289TR) Avail: NTIS CSCL 11/6

The analytical expressions presented in this report relate the crack velocity and the failure time to the surface-layer stress coefficient for compact-tension specimens of Ti-6Al-4V and a 4130 steel subjected to stress-corrosion cracking. The experimental data for the threshold stress intensity factor and velocities for various stress intensity factors agree well with the calculated values. Author (GRA)

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N74-34956+ National Aeronautical Lab., Bangalore (India). Information Centre for Aeronautics.
BIBLIOGRAPHY ON FATIGUE PROPERTIES OF FIBRE REINFORCED MATERIALS, 1962 - 1973
1973 70 p refs
(NAL-Bibl-Ser-54) Avail: NTIS HC $6.50

A bibliography on the fiber glass reinforced plastics and their mechanical properties, including fatigue and static strength is presented. Data are confined to the period from 1970 to 1972 only. E.H.W.

N74-34957 Rice Univ., Houston, Tex.
CONTINUUM THEORY FOR COMPOSITE MATERIALS Ph.D. Thesis
Tzu-Li Ho 1974 91 p
Avail: Univ. Microfilms Order No. 74-21279

The purpose of this dissertation is: (1) to formulate a mathematical model for several types of commonly used composite materials first through a close examination of their physical structures and then by use of some existing concepts in continuum mechanics, and (2) to avoid complicated mathematical manipulations and difficult experiments required to characterize the model so as to make the model suitable for practical engineering applications. Direct physical considerations lead to a modified set of laws of motions, field equations, and boundary conditions. The constitutive equations of non-heat-conducting elastic composites are studied in detail. Linear approximation of the model is also developed together with a method for obtaining material parameters of the structural continuum. Results of wave dispersions are obtained explicitly for laminated composites, fiber reinforced composites, and honeycomb cores and are compared with those of others in both theoretical and experimental literatures. Dissert. Abstr.

N74-34958*# Kentucky Univ., Lexington. College of Engineering.
MECHANICAL BEHAVIOR OF POLYCRYSTALLINE CERAMICS: BRITTLE FRACTURE OF SiC-Si3N4 MATERIALS Final Report
Martin H. Leipold, Cawas M. Kapadia, and Anant H. Kelkar Apr. 1974 57 p refs
(Grant NGL-18-001-042)
(NASA-CR-140409; UKY-TR84-74-MET19) Avail: NTIS HC $6.00 CSCL 11D

Various properties of ceramic materials were investigated. Magnesium oxide and the role of anion impurities were investigated together with the slow crack growth in silicon nitride-silicon carbide ceramics. The oxide program involved development of fabrication techniques for anion doped materials and evaluation of the role of these anions in the hot pressing response, grain boundary diffusion of nickel doped material, grain boundary microhardness, and grain growth. The carbide-nitride work employed commercial materials and the research involved evaluation of a recently reported technique for study of slow crack growth and the development of data for these commercial materials. Author

N74-34959*# Materials Sciences Corp., Blue Bell, Pa.
A STUDY OF RSI UNDER COMBINED STRESSES
J. J. Kibler and B. W. Rosen Sep. 1974 68 p refs
(Contract NAS1-12967)
(NASA-CR-132507; TFR/1024/7408) Avail: NTIS HC $3.75 CSCL 11D

The behavior of typical rigidized surface insulation material (RSI) under combined loading states was investigated. In particular, the thermal stress states induced during reentry of the space shuttle ware of prime concern. A typical RSI tile was analyzed for reentry thermal stresses under computed thermal gradients for a model of the RSI material. The results of the thermal stress analyses were then used to aid in defining typical combined stress states for the failure analysis of RSI. Author

N74-34960*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TAILOR MAKING HIGH PERFORMANCE GRAPHITE FIBER REINFORCED PMR POLYIMIDES
T. T. Serafini and R. D. Vannucci [1974] 13 p refs Proposed for Presentation at 13th Ann. Reinforced Plastic Composites Conf., Washington, D. C., 4-7 Feb. 1975; sponsored by Soc. of the Plastics Ind.
(NASA-TM-X-71616; E-8126) Avail: NTIS HC $3.00 CSCL 11D

Studies performed to demonstrate the feasibility of using the polymerization of monomer reactants (PMR) approach to tailor make processable polyimide matrix resins are described. Monomeric reactant solutions containing the dimethyl ester of 3,3',4,4' -benzophenonetetracarboxylic acid, 4, 4' -methylenedianiline and the monomethyl ester of 5-norbornene-2, 3-dicarboxylic acid were used to impregnate Hercules HTS graphite fiber. Six

different monomeric reactant stoichiometries were studied. The processing characteristics and elevated temperature mechanical properties of the PMR polyimide/HTS graphite fiber composites are described. Author

N74-34961*# Dow Chemical Co., Walnut Creek, Calif.
DEVELOPMENT OF POTASSIUM ION CONDUCTING HOLLOW GLASS FIBERS Final Technical Report
F. Y. Tsang 21 Oct. 1974 37 p
(NASA-CR-134706) Avail: NTIS HC $5.00 CSCL 11D

Potassium ion conducting glasses, chemically resistant to potassium, potassium sulfide and sulfur, were made and their possible utility as the membrane material for a potassium/sulfur battery was evaluated. At least one satisfactory candidate was found. It possesses an electrical resistance which makes it usable as a membrane in the form of a fine hollow fiber. It's chemical and electrochemical resistances are excellent. The other aspects of the possible potassium sulfur battery utilizing such fine hollow fibers, including the header (or tube sheet) and a cathode current collector were studied. Several cathode materials were found to be satisfactory. None of the tube sheet materials studied possessed all the desired properties. Multi-fiber cells had very limited life-time due to physical failure of fibers at the fiber/tube sheet junctions. Author

N74-34962*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
IN SITU POLYMERIZATION OF MONOMERS FOR POLYPHENYLQUINOXALINE-GRAPHITE FIBER COMPOSITES
Tito T. Serafini, Peter Delvigs, and Raymond D. Vannucci Oct. 1974 18 p refs Presented at the 29th Ann. Conf. of the Soc. of the Plastics Ind., Reinforced Plastic Composites Conf., Washington, D. C., 4-8 Feb. 1974
(NASA-TN-D-7793; E-7732) Avail: NTIS HC $3.00 CSCL 11D

In situ polymerization of monomers was used to prepare graphite-fiber-reinforced polyphenylquinoxaline composites. Six different monomer combinations were investigated. Composite mechanical property retention characteristics were determined at 316 C (600 F) over an extended time period. Author

N74-34963# Air Force Packaging Evaluation Agency, Wright-Patterson AFB, Ohio.
COMPARISON OF CUSHIONING PROPERTIES OF MICROFOAM AND KIMCEL VERSUS AIR CAP WRAP MATERIALS
Richard V. Brown Apr. 1974 27 p
(AFPEA Proj. 73-9-D-25)
(AD-782007; DSPT-73-54-74) Avail: NTIS CSCL 13/4

The purpose of this study was to evaluate various plastic wrap materials of foam sheet or flexible cellular structure to determine comparative cost-effectiveness of these materials for various protection levels and loading requirements. Peak G versus Static Stress curves and creep data were developed and compared with like data abstracted from a previous study on a similar wrap material. The data collected in this study indicated that for the fragility levels and static stress regions considered, cost savings of 45 to 50% are possible by careful selection of the correct material. Author (GRA)

N74-34964# Naval Ordnance Lab., White Oak, Md.
ULTRASONIC PROPERTIES OF PHENOLIC AND POLYPHENYLQUINOXALINE POLYMERS
Bruce Hartmann 6 Jun. 1974 31 p refs
(AD-782584; NOLTR-74-90) Avail: NTIS CSCL 11/9

The report describes experimental work done in measuring ultrasonic sound speeds and absorptions as a function of temperature in phenolic and polyphenylquinoxaline (PPQ) polymers. Supplementing the ultrasonic measurements, specific volume and specific heat measurements were also made. The purpose of these measurements was to determine the effect of cross-linking on the macroscopic properties of polymers. Sound absorption was found to depend on degree of cross-linking so that absorption may be useful in monitoring or measuring degree of cross-linking, one of the important variables in determining the useful properties of thermosetting polymers. A transition is indicated in phenolic, but not PPQ. This transition leads to pronounced temperature dependence in many of the properties of phenolic. GRA

N74-34965# Southwest Research Inst., San Antonio, Tex. Dept. of Materials Sciences.
THERMO-MECHANICAL BEHAVIOR OF COMPOSITES Final Report
U. S. Lindholm, William L. Ko, Phillip H. Francis, Andrew Nagy, and Sol R. Bodner Jun. 1974 76 p refs
(Contract F44620-71-C-0071; AF Proj. 9782; SwRI Proj. (AD-783306; AFOSR-74-1281TR) NTIS CSCL 11/4

Part 1 of this report uses a discrete theory to generate elastic solutions for stress concentration problems in filamentary materials containing cracks of arbitrary geometry. Experimental crack extension data for several filamentary materials are compared with theoretical predictions. In Part 2, an incremental criterion for the time dependent failure of materials is developed based upon the concept that failure results from an incremental accumulation of damage. The failure criterion is thereby explicitly tied to the incremental flow law describing the inelastic deformation. The damage increment is assumed as a product of a functional of the stored strain energy due to inelastic deformations and a functional of the mean hydrostatic stress. The consequences of the failure criterion for various types of loading are discussed. (Modified author abstract) GRA

N74-34966# Imperial Coll. of Science and Technology, London (England). Lubrication Lab.
VISCOSITY OF A NUMBER OF OILS MEASURED WITH A HIGH PRESSURE IMPACT VISCOMETER AT VARIOUS TIMES AFTER IMPACT Final Report
Graham R. Paul and A. Cameron 1 May 1974 17 p refs
(Contract N00014-73-C-0107; NR Proj. 259-099)
(AD-782231) Avail: NTIS CSCL 11/8

Viscosity of a number of fluids is measured as a function of pressure up to 3GN/sq m. It has been found that after a pressure pulse the fluid takes a finite time to reach an equilibrium viscosity. At high pressures the viscosity becomes independent of pressure. Author (GRA)

N74-34967# Avco Corp., Lowell, Mass. Systems Div.
MICROSTRUCTURE STUDIES OF POLYCRYSTALLINE REFRACTORY COMPOUNDS Summary Report, May 1973 - Apr. 1974
William H. Rhodes and Rowland M. Cannon, Jr. Jun. 1974 74 p refs
(Contract N00019-73-C-0376)
(AD-782647) Avail: NTIS CSCL 11/2

Modifications were made in the press forging of three-inch Al_2O_3 hemispheres to eliminate cracking and surface reactions and yet maintain optical transmission resulting from crystallographic texture and high density. Further forgings of Si_3N_4 were conducted. Process modifications resulted in densities of over 98% with little or no edge cracking. Three additional Al_2O_3 powders were investigated in the continuing effort to identify and eliminate strength limiting flaws in hot pressed Al_2O_3. The predominant flaws found were large grain size zones and particulate inclusions. Fracture surface energies calculated from the indicated flaw size were much closer to those directly measured for single crystals than for polycrystalline material. Measurements of the solubility of carbon in Al_2O_3 were made after annealing in CO and CO_2. (Modified author abstract) GRA

N74-34968# Picatinny Arsenal, Dover, N.J.
OPTICAL AND ESR STUDIES OF IRON DOPED LEAD AZIDE POWDERS
D. S. Downs, A. C. Forsyth, and H. D. Fair, Jr. Jun. 1974 27 p refs
(AD-781949; PA-TR-4689) Avail: NTIS CSCL 20/12

Optical reflectance and electron spin resonance spectra have been obtained for iron doped lead azide prepared by several different procedures. The results indicate that iron is incorporated in lead azide as either $Fe(2+)$ or $Fe(3+)$ depending upon the method of preparation. Based upon the electron spin resonance data, it is suggested that $Fe(3+)$ ions in the lead azide lattice are in a highly perturbed environment and are probably closely associated with the charge compensating defect. Models

are proposed for the various types of defect associates which can occur. Author (GRA)

N74-34969# University of South Florida, Tampa.
MECHANICS OF COMPOSITE MATERIALS Final Report, 1 Jul. 1970 - 30 Sep. 1973
John E. Griffith 1974 9 p
(Grant DA-ARO(D)-31-124-70-G80)
(AD-782783; AROD-6378-4-E) Avail: NTIS CSCL 11/4

The purpose of this research was to determine the fracture characteristics of particulate (filler) composite materials consisting of an epoxy matrix and either glass or metal fillers. The modes of initial failure and subsequent fracture were considered for establishment of criteria dependent on filler to matrix volume ratio and finite length filler geometry. No increase in strength was detected as a consequence of increasing filler content. On the contrary, increasing glass bead filler content simply lessened the matrix strength in proportion to decreasing matrix volume despite increasing the stiffness of the composite. Strength and stiffness increases were detected for increased finite length metallic filler composite. The consistent fracture criterion was attainment of a critical strain in the epoxy matrix. The distinct step leading to fracture were (1) debonding failure of fibers from the matrix, (2) matrix tearing, (3) friction pull-out of fibers spanning the fracture line. (Modified author abstract) GRA

N74-34970# Auburn Univ., Ala. Engineering Experiment Station.
SHEAR STRESS DISTRIBUTIONS IN COMPOSITE MODELS WITH FLAWS Final Report, Apr. 1972 - Sep. 1973
Walter H. Peters, III, William F. Ranson, III, Weldon F. Swinson, and Richard Tucker Jun. 1974 106 p refs
(Contract DAAH01-71-C-0976)
(AD-782957; ME-AMC-0976) Avail: NTIS CSCL 11/4

The report consists of two parts. In part 1, data is presented to note the effect of a flaw in a composite material structure. The flaws introduced were unbonded fibers and broken fibers. The models were made of glass fibers and in epoxy matrix. Shear stress data around the flaw regions were extracted using scattered light photoelasticity. The fibers were biased at 90 degrees, 75 degrees, and 45 degrees. The effect on the stress distribution of an unbonded fiber model was much more pronounced than with a broken fiber and would effect design procedures. In part 2, the speckle reference beam technique has been shown to be a dependable method of uniquely obtaining two components of displacement. The technique can be used in real time work and application in the area of composite model work, in dynamic work and in nonlinear work. (Modified author abstract) GRA

N74-34971# Babcock and Wilcox Co., Lynchburg, Va. Research Center.
REINFORCED THERMOPLASTICS Final Report, 1 Jul. - 31 Dec. 1973
William G. Long Apr. 1974 30 p refs
(Contract DAAG46-73-C-0283; DA Proj. 1W1-62113-A-660)
(AD-782760; TRG-74-10; AMMRC-CTR-74-32) Avail: NTIS CSCL 11/4

The report contains the results of a research program to identify the properties of a series of continuous unidirectional fiber reinforced thermoplastic matrices. Graphite fibers with a modulus of 30 million psi and 60 million psi and Kevlar 49 fibers were employed, and the matrices were nylon, polycarbonate, noryl, polysulfone, and polyphenylquinoxaline. Prepregs were formed and then pressed into panels of approximately .090 inch thickness. Testing which was performed included fiber content, composite density, C-scan evaluation, flexural strength and modulus, horizontal short beam shear strength, and Izod impact strength. The latter two properties were determined before and after environmental exposure. These properties are compared to the properties generated with epoxy matrices. Author (GRA)

N74-34972# Whittaker Corp., San Diego, Calif. Research and Development Div.
EXPLORATORY DEVELOPMENT OF HIGH TEMPERATURE CIRCUIT ANALOG RADAR ABSORBING MATERIALS CA-RAM Summary Report, 1 Jul. 1971 - 30 Jun. 1972
Vance A. Chase Apr. 1974 89 p
(Contract F33615-71-C-1795; AF Proj. 7350)
(AD-783291; MJO-3030; AFML-TR-73-91) Avail: NTIS CSCL 17/4

The objective of the program is the development of high temperature circuit analog radar absorbing materials, designs and prototypes. Material development efforts have involved silica fiber reinforced ceramic composites based on a chemically reacted aluminum phosphate (AlPO4) ceramic matrix. Matrix development has involved approaches to achieve thermal expansion compatible with the fibrous reinforcement, while maintaining satisfactory mechanical and electrical properties over an ambient to 1600F range. Simplified fabrication processing characteristics for the composites have been emphasized. (Modified author abstract) GRA

N74-34973# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PLASMA REINFORCED CERAMIC COATINGS
D. M. Karpinos, V. G. Zilberberg, and V. S. Klimenko 27 Jun. 1974 14 p refs Transl. into ENGLISH from the book "Trudy v Vsesoyuznogo Soveshchaniya po Zharostoikim Pokrytiyam" USSR, 1972 p 100-106
(FTD Proj. T74-01-43; FTD Proj. T73-01-11)
(AD-783045; FTD-HT-23-1301-74) Avail: NTIS CSCL 11/3

The introduction of metal reinforcement (W, Mo) into the plasma ceramic Al2O3 coatings results in the following: increased strength of their adhesion to the substrate and a prolonged service life due to a firm contact ensured by welding the reinforcing elements; decrease in the thermal expansion coefficient (KTR) of coatings and a decrease in the difference in the KTR values of the substrate and coating, facilitating a decrease in the developing thermal stresses and an increase in the thermal stability of coatings; increased thermal conductivity of coatings, which leads to the equalization of temperature fields, decrease in thermal stresses and, consequently, to increased thermal stability of coatings. GRA

N74-34974# Army Materials and Mechanics Research Center, Watertown, Mass.
TITANIUM-BERYLLIUM MICROCOMPOSITES, STATE-OF-THE-ART REVIEW Final Report
Saul Isserow Apr. 1974 12 p refs
(DA Proj. 1T1-62105-A-331)
(AD-783180; AMMRC-MS-74-5) Avail: NTIS CSCL 11/4

Titanium-beryllium composites have been developed over a broad range of compositions to take advantage of the low density and high modulus of the beryllium while the titanium provides strength and toughness. Standard metalworking methods can be used to prepare these fiber-reinforced composites from powder blends (hence the designation, microcomposites) and for subsequent processing to finished components. This report reviews the history of the development of these materials and presents data from several sources. Potential applications are indicated. Author (GRA)

N74-34975# Virginia Polytechnic Inst. and State Univ., Blacksburg. Coll. of Engineering.
INFLUENCE OF CYCLE FREQUENCY ON COMPOSITE FATIGUE RELIABILITY
Kenneth L. Reifsnider, W. W. Stinchcomb, Richard S. Williams, and H. M. Turgay Apr. 1974 33 p refs
(Grant AF-AFOSR-2358-72; AF Proj. 9781)
(AD-783228; AFOSR-74-1201TR) Avail: NTIS CSCL 11/4

Variations in the degradation and subsequent fatigue reliability of laminated composite plate specimens with a center hole due to changes in cycle frequency have been identified and investigated. Boron-epoxy and born-aluminum specimens were examined, principally for stiffness and strength variations. Various combinations of stiffness and strength changes were observed as a function of cycle frequency and specimen material, including a mode wherein stiffness decreased significantly while residual strength increased. A kinetic damage model was developed and combined with a Weibull extreme value expression to attempt to represent the stochastic aspects of the fatigue process. The model shows considerable promise, especially from the standpoint of representing widely varying fatigue behavior, including the

unusual stiffness drop with strength increase situation. Frequency dependence is included in the model. Author (GRA)

N74-34976# Virginia Polytechnic Inst. and State Univ., Blacksburg. Coll. of Engineering.
CHARACTERIZATION OF ACOUSTIC EMISSION DURING FATIGUE LOADING OF COMPOSITE
Richard S. Williams and Kenneth L. Reifsnider May 1974 30 p refs
(Grant AF-AFOSR-2358-72; AF Proj. 9781)
(AD-783227; AFOSR-74-1200TR) Avail: NTIS CSCL 11/4

Strain and load controlled fatigue tests were run on boron-aluminum and boron-epoxy angle-plied specimens. Acoustic emission data was recorded using a gating technique that eliminated most extraneous noise. Various material parameters were monitored during the test. A good correlation between acoustic emission and damage extent and propagation was obtained. This was evidenced by an apparent first order linear relationship between dynamic compliance and totalized acoustic emission. A basis for an energy based failure model was formulated and discussed. Author (GRA)

N74-34977# Aerospace Corp., El Segundo, Calif. Lab. Operations.
THE EFFECTS OF THERMAL CYCLING ON THE STRENGTH OF ALUMINUM-GRAPHITE COMPOSITES Interim Report
William C. Harrigan, Jr. 31 Jul. 1974 22 p refs
(Contract F04701-74-C-0075)
(AD-783645; TR-0075(9250-03)-1; SAMSO-TR-74-159) Avail: NTIS CSCL 11/4

Room temperature tensile tests were conducted on specimens of 6061 aluminum-Thornel 50 graphite composite after thermal exposure for up to 3000 hours at 465C and thermal cycling between room temperature and 485C or 400C for up to 5000 cycles. These tests demonstrate that the ultimate strength of the composite is not affected by thermal exposure at 465C for 3000 hours or by thermal cycling between room temperature and 400C for 5000 cycles. The tensile modulus is also unaffected by exposure at 465C or cycling to 400C. Cycling between room temperature and 485C for 5000 cycles causes a 9% decrease in the strength with no decrease in modulus.
Author (GRA)

N74-34978# Army Foreign Science and Technology Center, Charlottesville, Va.
COMPOSITE MATERIALS REINFORCED WITH FILIFORM CRYSTALS
S. Z. Bokshtein, S. T. Kishkin, and I. L. Svetlov 9 Aug. 1973 11 p refs Transl. into ENGLISH from the monograph "Metallovedenie" Moscow, 1971 p 137-142
(AD-783756; FSTC-HT-23-2516-72) Avail: NTIS CSCL 11/4

The article shows how the strength of industrial materials can be increased by the creation of composites reinforced with filiform crystals. The technological problems involved in this process are discussed. GRA

N74-34979# Army Foreign Science and Technology Center, Charlottesville, Va. Transl. into ENGLISH from Fiz. Khim. Obrab. Mater. (Moscow), no. 6, 1972 p 107-113
EFFECT OF ALLOYING A NICKEL MATRIX WITH THE METAL OF REINFORCING FIBERS ON STRUCTURAL STABILITY OF NICKEL-TUNGSTEN AND NICKEL-MOLYBDENUM COMPOSITE MATERIALS
D. M. Karpinos, L. I. Tuchinskii, L. R. Vishnyakov, L. N. Pereselentseva, and L. N. Klimenko 15 Apr. 1974 16 p refs
(AD-783746; FSTC-HT-23-444-74) Avail: NTIS CSCL 11/4

Producing structure-stable composite materials for the nickel-tungsten and nickel-molybdenum systems is examined. By alloying a matrix with tungsten to the limiting saturation of a nickel solution, models specimens reinforced with tungsten wire are obtained, in which the reinforcements do not dissolve to temperatures of 1000-1200C. GRA

N74-34980# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STATIC TESTING OF REINFORCED PLASTICS: A REFERENCE MANUAL (INTRODUCTION AND CHAPTER 6)
28 Jun. 1974 28 p Transl. into ENGLISH from the book "Metody Staticheskikh Ispytanii Armirovannykh Plastikov. Spravochnoe Posobie" USSR, 1972 p 7-8, 191-208
(FTD Proj. T74-01-43; FTD Proj. T74-04-11)
(AD-783579; FTD-MT-24-1351-74) Avail: NTIS CSCL 11/4

Loading procedures are described for static tests of ring and pipe structures made of reinforced composites. F.O.S.

N74-34981# Southern Research Inst., Birmingham, Ala.
NONDESTRUCTIVE EVALUATIONS OF COMPOSITE HEATSHIELD MATERIALS BEFORE AND AFTER AN UNDERGROUND NUCLEAR EXPOSURE Final Report, May 1972 - Nov. 1973
James R. Brown, Jr., H. G. Sanders, and C. D. Pears Jun. 1974 122 p
(Contract F29601-72-C-0058; AF Proj. 627A)
(AD-783851; AFWL-TR-73-247) Avail: NTIS CSCL 11/4

Nondestructive evaluations were performed on various composite heatshield materials before and after underground nuclear exposure. Quality control nondestructive evaluations were used to select representative rings from a larger sample. Additional nondestructive testing and nondestructive mechanical (NDM) evaluations were used to characterize the selected rings before and after exposure. Improved methods of characterizing rings after exposure were developed and will be implemented in Carbon-Carbon Design Program. The materials evaluated included an angled, tape-wrapped carbon-phenolic (R6300); 3D carbon/quartz-phenolic 3DC/QP); 3D carbon-phenolic (3DCP); 3D carbon-carbon (3DCC); and felt carbon-carbon (felt CC). All materials were evaluated before underground exposure. After exposure the R6300, 3DCC, and felt CC were evaluated. In the follow-on program the two CC materials will receive further evaluations. Author (GRA)

N74-34982# United Aircraft Corp., East Hartford, Conn. Research Labs.
EXPLORATORY DEVELOPMENT ON LOW-COST PRIMARY FABRICATION PROCESSES FOR BORON-ALUMINUM COMPOSITES Final Report Jun.-Nov. 1973
Karl M. Prewo Mar. 1974 85 p refs
(Contract F33615-73-C-5152; AF Proj. 7351)
(AD-783293; UARL-N911705-7; AFML-TR-74-40) Avail: NTIS CSCL 11/4

Boron fiber reinforced aluminum matrix composites can be successfully fabricated in air with total hot pressing times of ten minutes or less. These composites have been fabricated without the need for elaborate bagging or out-gassing procedures and demonstrate that significant cost savings in processing can be achieved without any sacrifice in composite performance. The process procedure, referred to as Quick Bonding, is fully described in the report along with resultant composite tensile and fatigue properties. Composite panels were fabricated in constant and nonconstant cross section configurations with composite panel dimensions exceeding those of the hot press using single and multiple step pressing procedures. Specimens exhibited axial tensile strengths of up to 290,000 psi, transverse tensile strengths of 30,000 psi and transverse tensile failure strains of over 1%.
Author (GRA)

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

N74-34983 Turku Univ. (Finland).
A SHORT PROOF FOR THE NONEXISTENCE OF UNKNOWN PERFECT CODES OVER GF(q), q MORE THAN OR EQUAL TO 2
Aimo Tietaevaeinen Helsinki Suomalainen Tiedeakatemia 1974 8 p refs
(Rept-580; ISSN-0066-1953; ISBN-951-41-0176-6)
Copyright Avail: Issuing Activity

It is known that there are e-error-correcting perfect codes of length n over GF(q), where $q > 2$, in the cases where $e = 1$, $e = 2$ (if $q = 3$), and $e = n$. It was proven that there are

no perfect codes when $q > 2$, $2 < e < n$, however, the proofs were very long and complicated. A short proof is given which yields the same conclusion, but with less effort. Author

N74-34984*# Northwestern Univ., Evanston, Ill. Dept. of Industrial Engineering and Management Sciences.
SEQUENTIAL DECISION ANALYSIS FOR NONSTATIONARY STOCHASTIC PROCESSES Final Technical Report
Brian Schaefer Oct. 1974 16 p refs
(Grant NGR-14-007-129)
(NASA-CR-140625) Avail: NTIS HC $4.00 CSCL 12A

A formulation of the problem of making decisions concerning the state of nonstationary stochastic processes is given. An optimal decision rule, for the case in which the stochastic process is independent of the decisions made, is derived. It is shown that this rule is a generalization of the Bayesian likelihood ratio test; and an analog to Wald's sequential likelihood ratio test is given, in which the optimal thresholds may vary with time. Author

N74-34985*# Rice Univ., Houston, Tex. Inst. for Computer Services Applications.
CLASSIFICATION BY MEANS OF B-SPLINE POTENTIAL FUNCTIONS WITH APPLICATIONS TO REMOTE SENSING
J. O. Bennett, R. J. P. DeFigueiredo, and J. R. Thompson May 1974 9 p refs Repr. from Proc. of the 6th Southeastern Symp. on System Theory, Baton Rouge, La.; Sponsored by IEEE Sponsored in part by ONR
(Contract NAS9-12776; Grant NSF GK-36375; NR Proj. 042-283)
(NASA-CR-140297; ICSA-275-025-015) Avail: NTIS HC $4.00 CSCL 12A

A method is presented for using B-splines as potential functions in the estimation of likelihood functions (probability density functions conditioned on pattern classes), or the resulting discriminant functions. The consistency of this technique is discussed. Experimental results of using the likelihood functions in the classification of remotely sensed data are given. Author

N74-34986*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PROGRAM FOR THE ANALYSIS OF TIME SERIES
Thomas J. Brown (Army Air Mobility R and D Lab.), Christine G. Brown, and Jay C. Hardin Washington Sep. 1974 118 p refs
(NASA-TM-X-2988; L-9278) Avail: NTIS HC $4.50 CSCL 12A

A digital computer program for the Fourier analysis of discrete time data is described. The program was designed to handle multiple channels of digitized data on general purpose computer systems. It is written, primarily, in a version of FORTRAN 2 currently in use on CDC 6000 series computers. Some small portions are written in CDC COMPASS, an assembler level code. However, functional descriptions of these portions are provided so that the program may be adapted for use on any facility possessing a FORTRAN compiler and random-access capability. Properly formatted digital data are windowed and analyzed by means of a fast Fourier transform algorithm to generate the following functions: (1) auto and/or cross power spectra, (2) autocorrelations and/or cross correlations, (3) Fourier coefficients, (4) coherence functions, (5) transfer functions, and (6) histograms. Author

N74-34987# Helsinki Univ. of Technology, Otaniemi (Finland). Radio Lab.
COORDINATE-FREE REPRESENTATIONS OF THE POLARIZATION OF TIME HARMONIC VECTORS
Ismo V. Lindell 1974 27 p refs
(S-66; ISBN-951-750-280-X) Avail: NTIS HC $4.50

The polarization concept and its representation are defined, and different coordinate-free representations are considered in the general case. Properties and interrelations of these representations are derived, and a geometrical interpretation of polarization match factor for general vectors is given. Also a geometrical result for two orthogonal polarizations is shown. Author

N74-34988*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
POWER-SPECTRAL-DENSITY RELATIONSHIP FOR RETARDED DIFFERENTIAL EQUATIONS
L. Keith Barker Washington Oct. 1974 17 p refs
(NASA-TN-D-7761; L-9735) Avail: NTIS HC $3.00 CSCL 12A

The power spectral density (PSD) relationship between input and output of a set of linear differential-difference equations of the retarded type with real constant coefficients and delays is discussed. The form of the PSD relationship is identical with that applicable to unretarded equations. Since the PSD relationship is useful if and only if the system described by the equations is stable, the stability must be determined before applying the PSD relationship. Since it is sometimes difficult to determine the stability of retarded equations, such equations are often approximated by simpler forms. It is pointed out that some common approximations can lead to erroneous conclusions regarding the stability of a system and, therefore, to the possibility of obtaining PSD results which are not valid. Author

N74-34989*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A VECTOR-DYADIC DEVELOPMENT OF THE EQUATIONS OF MOTION FOR N-COUPLED RIGID BODIES AND POINT MASSES
Harold P. Frisch Washington Oct. 1974 68 p refs
(NASA-TN-D-7767; G-7435) Avail: NTIS HC $3.75 CSCL 12A

The equations of motion are derived, in vector-dyadic format, for a topological tree of coupled rigid bodies, point masses, and symmetrical momentum wheels. These equations were programmed, and form the basis for the general-purpose digital computer program N-BOD. A complete derivation of the equations of motion is included along with a description of the methods used for kinematics, constraint elimination, and for the inclusion of nongyroscope forces and torques acting external or internal to the system. Author

N74-34990*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
CLASSICAL SEVENTH-, SIXTH-, AND FIFTH-ORDER RUNGE-KUTTA-NYSTROM FORMULAS WITH STEPSIZE CONTROL FOR GENERAL SECOND-ORDER DIFFERENTIAL EQUATIONS
Erwin Fehlberg Washington Oct. 1974 91 p refs
(NASA-TR-R-432; M-546) Avail: NTIS HC $4.00 CSCL 12A

Runge-Kutta-Nystrom formulas of the seventh, sixth, and fifth order were derived for the general second order (vector) differential equation written as the second derivative of $x = f(t, x,$ the first derivative of $x)$. The formulas include a stepsize control procedure, based on a complete coverage of the leading term of the local truncation error in x, and they require no more evaluations per step than the earlier Runge-Kutta formulas for the first derivative of $x = f(t, x)$. The developed formulas are expected to be time saving in comparison to the Runge-Kutta formulas for first-order differential equations, since it is not necessary to convert the second-order differential equations into twice as many first-order differential equations. The examples shown saved from 25 percent to 60 percent more computer time than the earlier formulas for first-order differential equations, and are comparable in accuracy. Author

N74-34991# Maryland Univ., College Park. Center for Theoretical Physics.
IS THE HIGGS-KIBBLE MECHANISM NECESSARY FOR UNIFIED GAUGE THEORIES?
J. Sucher Jul. 1974 22 p refs Presented at 9th Balaton Symp. on Particle Phys., Balatonfuered, Hungary, 12-18 Jun. 1974
(Grant NSF GP-418-22X)
(TR-75-010) Avail: NTIS HC $4.25

The construction of unified gauge theories of weak, electromagnetic, and strong interactions are presented. Central roles in the construction of Lagrangian field theories which exhibit this unification are discussed. M.C.F.

N74-34992# European Organization for Nuclear Research, Geneva (Switzerland).
NUMERICAL CALCULATION OF SUCCESSIVE PARTIAL DERIVATIVES OF FUNCTIONS WITH TWO AND THREE VARIABLES
J. F. Barthelemy 28 Mar. 1974 43 p refs In FRENCH
(CERN-74-7) Avail: AEC Depository Libraries HC $5.25

A subprogram which permits calculation of the numerical value of partial derivatives as a function of two real variables was proposed. The program also allows general methods to be developed for obtaining functions of variables. The report concentrates on drafting a subprogram which: permits examples of the application to be obtained and develops limits for it, calculates integrals, and provides for numerical integration of equations of partial derivatives. Transl. by E.H.W.

N74-34993# State Univ. of New York, Buffalo. Statistical Lab.
SOME SOLUTIONS TO THE TIME SERIES MODELING AND PREDICTION PROBLEM
E. Parzen Feb. 1974 27 p refs
(Contract N00014-72-C-0508)
(AD-781872; TR-5) Avail: NTIS CSCL 12/1

Using prediction k-steps ahead (for k = 1, ...,h, a specified horizon) as the aim, the time series' modeling problem is defined as determining the (infinite autoregressive) filter, transforming the data to white noise. A finite parameter scheme is an approximate model rather than a true model. A procedure is described for optimally estimating the frequency transfer function (ARTF) of this filter by means of the frequency transfer function (ARTFACT) of an autoregressive scheme to suitable order m. In effect, a solution is offered to the problem of determining the order of finite parameter (ARMA) models to be fitted to stationary time series data. Author (GRA)

N74-34994# Michigan Univ., Ann Arbor. Systems Engineering Lab.
SYSTEM IDENTIFICATION: A STATE SPACE APPROACH
Wilmer Kreider Schnure Mar. 1974 181 p refs
(Grant AF-AFOSR-2427-73; AF Proj. 9749)
(AD-782183; SEL-TR-80; Rept-01131-9-T;
AFOSR-74-1046TR) Avail: NTIS CSCL 12/1

The report solves a general system identification problem. The problem is general in the sense that it is couched in an abstract mathematical setting which covers several specific cases. It can be stated as follows: Suppose that a causal system represented by an operator on a Hilbert resolution space (a Hilbert space together with an arbitrary resolution of the identify) is not known, but its responses to certain input vectors are. The problem is to process this information so that the operator can be recovered, or identified. This dissertation shows that because the unknown operator was assumed to be causal, careful attention must be given to the time structure--time structure being provided by the resolution of the identity--of the information before this problem can be solved. (Modified author abstract) GRA

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N74-34995 NATO Committee on the Challenges of Modern Society.
PROCEEDINGS OF THE THIRD MEETING OF THE EXPERT PANEL ON AIR POLLUTION MODELING
3 Oct. 1972 307 p refs Meeting held at Paris, 2-3 Oct. 1972
(Rept-14) Avail: Air Pollution Technical Information Center, Research Triangle Park, N. C. 27711

Modeling of the dispersion of air pollutants in urban areas for the maintenance of air quality standards is discussed at this conference. For individual titles, see N74-34996 through N74-35017.

N74-34996 NATO Committee on the Challenges of Modern Society.
NATO/CCMS AIR POLLUTION STUDY: EXPERT PANEL ON MODELING
Kenneth L. Calder *In its* Proc. of the 3d Meeting of the Expert Panel on Air Pollution Modeling 3 Oct. 1972 26 p refs (For availability see N74-34995 24-20)

Developments and procedures in the field of air quality modeling center on model validation, sensitivity analysis and computation economy with emphasis on the dispersion of air pollutants in urban areas. G.G.

N74-34997 Environmental Protection Agency, Research Triangle Park, N.C.
OPENING REMARKS
R. A. McCormick *In* NATO Comm. on the Challenges of Mod. Soc. Proc. of the 3d Meeting of the Expert Panel on Air Pollution Modeling 3 Oct. 1972 7 p (For availability see N74-34995 24-20)

A brief outline is given of the pilot research projects for air pollution control. Considered are primarily industry or stationary sources of sulfur oxides and particulate pollutants, as well as mobile sources of hydrocarbons, carbon monoxide, oxidants, and nitrogen oxides. G.G.

N74-34998 Ministerium fuer Arbeit, Gesundheit und Soziales, Dusseldorf (West Germany).
MODELING EFFORTS FOR COLOGNE
F. I. Dreyhaupt *In* NATO Comm. on the Challenges of Mod. Soc. Proc. of the 3d Meeting of the Expert Panel on Air Pollution Modeling 3 Oct. 1972 4 p (For availability see N74-34995 24-20)

Preliminary work on air pollution in the Cologne area aims at the development of complete emission inventory that lists all sources of air pollution in a limited region. Emissions of industrial sources are measured, calculated or estimated in collaboration with industrial personnel. Results show that more than 300 different emission components are present; refineries and petrochemical plants emitting a relatively high amount of organic gases and vapors near the ground. In the same industries, a large amount of organic gases is diffusively distributed by sources like leakages, tank losses, etc. G.G.

N74-34999 National Environmental Research Center, Research Triangle Park, N.C. Div. of Meteorology.
THE NATO/CCMS AIR POLLUTION STUDY OF SAINT LOUIS, MISSOURI
John Zimmerman *In* NATO Comm. on the Challenges of Mod. Soc. Proc. of the 3d Meeting of the Expert Panel on Air Pollution Modeling 3 Oct. 1972 15 p refs (For availability see N74-34995 24-20)

Analyses of sulfur oxide and particulate matter data for St. Louis show that elevated point sources deliver most of the pollutants of that area. Computer patterns of seasonal concentrations of sulfur oxide outline the major electrical power, industrial, and residential air pollution sources; sulfur oxide concentrations from a major power plant are predominant. Particulate matter values remain relatively constant throughout the year. G.G.

N74-35000 Istituto di Dinamica dell'Atmosfera dell' Osservatorio di Brera, Milano (Italy)
PROPOSAL FOR A MATHEMATICAL MODEL OF AIR POLLUTION SURVEY IN MILAN
L. Santomauro *In* NATO Comm. on the Challenges of Mod. Soc. Proc. of the 3d Meeting of the Expert Panel on Air Pollution Modeling 3 Oct. 1972 15 p refs (For availability see N74-34995 24-20)

The development of an air pollution prediction model for the area of Milan includes as a first step the preparation of a statistical climatic/dynamic model based on existing meteorological observations. Diffusion is formulated from the emission parameters by: (1) direction of air mass motion and small scale vorticity; (2) frequency of ventilation time as based on prevailing air mass flow path; (3) thickness of atmospheric mixing layer; and (4) determination of urban heat island. G.G.

N74-35001 Environmental Protection Agency, Research Triangle Park, N.C. Div. of Meteorology.

VALIDATION OF AIR QUALITY SIMULATION MODELS
Warren B. Johnson *In* NATO Comm. on the Challenges of Mod. Soc. Proc. of the 3d Meeting of the Expert Panel on Air Pollution Modeling 3 Oct. 1972 9 p refs (For availability see N74-34995 24-20)

The structure of an air quality simulation model is outlined that contains: (1) submodels for conversion and estimation of required model inputs; (2) main modules or physical formulations (emissions, transport and diffusion, transformations, and removal); and (3) calibration procedures. G.G.

N74-35002 Environmental Protection Agency, Research Triangle Park, N.C. Div. of Meteorology.
THE US REGIONAL AIR POLLUTION STUDY (RAPS)
R. A. McCormick *In* NATO Comm. on the Challenge of Mod. Soc. Proc. of the 3d Meeting of the Expert Panel on Air Pollution Modeling 3 Oct. 1972 16 p (For availability see N74-34995 24-20)

Scientific and technological aerometric tasks are outlined that are required to formulate air quality management schemes for major urban centers. Meteorological program activities involve evaluation and improvement of current air pollution models and development of new models, as well as instrumentation improvement and development. G.G.

N74-35003 Environmental Protection Agency, Research Triangle Park, N.C.
AN EVALUATION OF SOME CLIMATOLOGICAL DISPERSION MODELS
D. Bruce Turner, John R. Zimmerman, and Adrian D. Busse *In* NATO Comm. on the Challenges of Mod. Soc. Proc. of the 3d Meeting of the Expert Panel on Air Pollution Modeling 3 Oct. 1972 25 p refs (For availability see N74-34995 24-20)

Summarized results of a recent evaluation are reported of six different climatological dispersion models that had been used with point source and area source emission data to calculate annual sulfur dioxide concentrations and total suspended particulate matter for the New York region. Two of the models used joint frequency distributions of wind speed, wind direction and Pasquill-type atmospheric stability class as meteorological input data. A simplified version, based on use of only a single stability, required only a wind direction frequency and harmonic mean wind speed for each direction. Comparison of these models was based on calculation of mean annual SO2 concentrations. The most significant fact established by the study was that it is difficult to improve on the accuracy of the air quality predictions provided by simple models. The predictions of the latter are as highly correlated with measurements as those of more complex models. Author

N74-35004 National Oceanic and Atmospheric Administration, Idaho Falls Idaho. Air Resources Labs.
A REVIEW OF SOME TECHNIQUES FOR INVESTIGATING MESOSCALE TRANSPORT IN THE PLANETARY BOUNDARY LAYER
Larry L. Wendell *In* NATO Comm. on the Challenges of Mod. Soc. Proc. of the 3d Meeting on the Expert Panel on Air Pollution Modeling 3 Oct. 1972 13 p refs (For availability see N74-34995 24-20)

An objective interpolation technique is reported for obtaining wind components at regularly spaced grid points from measurements at non-regularly spaced towers, and illustrations of the uses of the interpolated wind field are given. The recent use for wind trajectory determination of a radar-tetroon-transponder system mounted on a constant density balloon is described. Some comparisons are made of trajectories estimated by both the interpolated wind field technique and tetroon observations with observations of the center line location of a plume of methyl iodide gas tracer material released into the atmosphere. Author

N74-35005 Environmental Protection Agency, Research Triangle Park, N.C. Div. of Meteorology.
MATHEMATICAL MODELING OF AIR QUALITY THROUGH CALCULATION OF ATMOSPHERIC TRANSPORT AND DIFFUSION
Kenneth L. Calder *In* NATO Comm. on the Challenges of Mod. Soc. Proc. of the 3d Meeting of the Expert Panel on Air Pollution Modeling 3 Oct. 1972 21 p refs (For availability see N74-34995 24-20)

The majority of current mathematical models for both large point source releases of SO2 and also the multiple source situations that characterize urban areas, all stem from the classical Gaussian plume representation of the concentration distribution from a continuous point source. Recent evidence indicates that a major simplification may be possible in multiple source urban models for stable pollutants, and that the massive numerical effort involved may be drastically reduced without seriously affecting the accuracy of the predictions. Author

N74-35006 Turkish Meteorological Office, Ankara. Synoptic Div.
A SYNOPTIC-CLIMATOLOGICAL STUDY OF AIR POLLUTION POTENTIAL FOR ANKARA
Taskin Tuna *In* NATO Comm. on the Challenges of Mod. Soc. Proc. of the 3d Meeting of the Expert Panel on Air Pollution Modeling 3 Oct. 1972 14 p refs (For availability see N74-34995 24-20)

A synoptic climatological study of air pollution potential for Ankara considers variations of the mixing depth throughout the year, the variation in depth of nocturnal surface based inversions that are frequently associated with high pressure systems and the frequency of inversions. Also, SO2 concentration data are reanalyzed in relation to synoptic weather features. Some empirical rules for forecasting air pollution levels in Ankara in terms of various meteorological factors are suggested. Author

N74-35007 Middle East Technical Univ., Ankara (Turkey). Mechanical Engineering Dept.
ON THE SELECTION OF SITES OF AIR POLLUTION SAMPLING STATIONS
Suha Selamoglu *In* NATO Comm. on the Challenges of Mod. Soc. Proc. of the 3d Meeting of the Expert Panel on Air Pollution Modeling 3 Oct. 1972 6 p ref (For availability see N74-34995 24-20)

The selection of sites for air pollution sampling stations takes into account various possible uses to which the air quality information might be put. Different distributions corresponding to different considerations relative to the use of the data are analyzed. This led formally to a problem in the mathematical theory of optimization. Author

N74-35008 Middle East Technical Univ., Ankara (Turkey). Mechanical Engineering Dept.
DETERMINATION OF THE ATMOSPHERIC TEMPERATURE AND DENSITY PROFILES FROM FREE DESCENT OR ASCENT OF A SPHERE OF CONSTANT VOLUME AND MASS
Suha Selamoglu *In* NATO Comm. on the Challenges of Mod. Soc. Proc. of the 3d Meeting of the Expert Panel on Air Pollution Modeling 3 Oct. 1972 10 p refs (For availability see N74-34995 24-20)

The determination of atmospheric temperature and density profiles from observations of the free descent or ascent of a sphere of constant mass and volume is considered. The density profile of the atmosphere is related to the velocities which would be acquired by a spherical body in its free fall or ascent through the atmosphere. Provided that the velocity history of such a sphere is recorded with sufficient accuracy, this information can be translated to give the density, temperature and pressure profiles of the atmosphere. Author

N74-35009 Royal Netherlands Meteorological Inst., De Bilt.
AIR POLLUTION EPISODES AND MATHEMATICAL MODELS
C. A. Velds *In* NATO Comm. on the Challenges of Mod. Soc. Proc. of the 3d Meeting of the Expert Panel on Air Pollution Modeling 3 Oct. 1972 10 p (For availability see N74-34995 24-20)

An air pollution episode is discusssed that occurred in the heavily industrialized area around Rotterdam. During the period an anticyclonic situation occurred with sunny weather, light winds and subsidence. As a measure of the air pollution level the SO2 concentrations at the 31 sampling sites of the automatic monitoring network were used. Meteorological observations included vertical temperature soundings, surface wind speeds, height of mixing layer and estimates of ventilation rate. The

study of the relation between meteorological parameters, the SO2 concentrations and the nuisance experienced by the public during this air pollution episode led to the conclusion that a relation is overruled by small variations in the meteorological parameters and maybe also in the emissions, and that probably it will be impossible to use a mathematical model for these situations. Author

N74-35010 Department of Environmental Care, Rijnmond (Netherlands).
AN AREA SOURCE MODEL WITH STATISTICAL INPUT, ITS VERIFICATION AND ITS VALIDATION: A STANDARD FOR ODOROUS POLLUTION
Louis A. Clarenburg *In* NATO Comm. on the Challenges of Mod. Soc. Proc. of the 3d Meeting of the Expert Panel on Air Pollution Modeling 3 Oct. 1972 13 p (For availability see N74-34995 24-20)

The penalization of the environment due to stench is considered, i.e., the percentage of the population living in a given area that is bothered by stench. This concept is described quantitatively in terms of a mathematical model and applied to the situation in five areas. Results of calculations are compared with the results of public polls and with the complaint pattern registered by a complaint office. The agreement between calculation and observation is highly significant in a statistical sense. Also considered are briefly an area source model and an SO2 model for The Hague. Author

N74-35011 Regionale Planungsgemeinschaft Utermain, Frankfurt (West Germany).
STATUS OF THE INVESTIGATIONS ON THE EMISSION INVENTORY OF THE DENSITY POPULATED AREA OF LOWER-MAIN (FRANKFURT)
W. Lamp *In* NATO Comm. on the Challenges of Mod. Soc. Proc. of the 3d Meeting of the Expert Panel on Air Pollution Modeling 3 Oct. 1972 15 p (For availability see N74-34995 24-20)

A mathematical model is developed for the distribution of sulfur dioxide that requires as input data related meteorological data as well as a detailed emission register. The register contains data on: (1) SO2 emissions resulting from factories; (2) SO2 emissions resulting from low capacity furnaces mainly in housing areas; and (3) CO emissions resulting from traffic. Author

N74-35012 Meteorological Office, Bracknell (England).
A SCHEME FOR ESTIMATING THE VERTICAL DISPERSION OF A PLUME FROM A SOURCE NEAR GROUND LEVEL
F. B. Smith *In* NATO Comm. on the Challenges of Mod. Soc. Proc. of the 3d Meeting of the Expert Panel on Air Pollution Modeling 3 Oct. 1972 14 p (For availability see N74-34995 24-20)

A new scheme is reported for estimation of the vertical spread of a plume downwind from a near ground level source. This is intended for use when the preferred direct measurements of the vertical fluctuations of the wind are not available, and when estimates have to be based on a rather broad description of the meteorological conditions. The first step in this process is to estimate the vertical standard deviation sigma sub (X) of the cloud, and secondly, to estimate the height of the mixing layer so as to modify the development of sigma sub (X) at greater downwind distances to reflect the rather slower evolutionary development of the mixing layer. Author

N74-35013 Meteorological Office, Bracknell (England).
THE PREDICTION OF HIGH CONCENTRATIONS OF SULPHUR DIOXIDE IN LONDON AND MANCHESTER AIR
F. B. Smith and G. H. Jeffrey *In* NATO Comm. on the Challenges of Mod. Soc. Proc. of the 3d Meeting of the Expert Panel on Air Pollution Modeling 3 Oct. 1972 6 p (For availability see N74-34995 24-20)

Daily average concentrations of sulphur dioxide in London and in Manchester are examined in detail for two winter periods. Attempts are made to explain the concentrations in terms of the prevailing meteorological situations day-by-day. Three statistical forecasting schemes have been developed: (1) the first provides a means of forecasting on any particular day whether or not certain threshold concentrations will be exceeded; (2) the second sets out to forecast the actual magnitude of the daily average concentration; (3) and the last scheme presents a simple version of the second scheme. Overall the schemes show very satisfactory measures of success in both cities and are much superior to using a persistence forecast. Author

N74-35014 Warren Spring Lab., Stevenage (England).
WARREN SPRING LABORATORY
Alstair Keddie *In* NATO Comm. on the Challenges of Mod. Soc. Proc. of the 3d Meeting of the Expert Panel on Air Pollution Modeling 3 Oct. 1972 2 p (For availability see N74-34995 24-20)

Urban air pollution models considered are of the Gaussian plume type, and advection type models based on numerical solution of the diffusion equation. The latter involve considerable use of the hybrid computer facility which is also used in attempts to model the photochemical smog of London. The largest project under detailed consideration is a combined survey modeling exercise for part of the industrial belt of central Scotland extending between Glasgow and Edinburgh. Author

N74-35015 Stockholm Electricity Board (Sweden).
MATHEMATICAL SYSTEM FOR CALCULATIONS OF SPREAD OF AIR POLLUTION IN THE GREATER STOCKHOLM AREA
Bjoern Bringfelt and Olof Wikstroem *In* NATO Comm. on the Challenges of Mod. Soc. Proc. of the 3d Meeting of the Expert Panel on Air Pollution Modeling 3 Oct. 1972 17 p (For availability see N74-34995 24-20)

An air pollution model is reported that is based on the Gaussian plume dispersion concept. It is essentially a short term model from which could be calculated the frequency distribution for the SO2 concentration occurring at arbitrary receptor locations over an extended period of time. Initial tests of the model have given quite good agreement with the observed frequency distributions, and both calculated and observed distributions were close to logarithmic normal. Author

N74-35016 Swedish Meteorological and Hydrological Inst., Stockholm.
A COMPARISON OF STABILITY MEASUREMENTS TO PASQUILL-TURNER STABILITY CLASSES
Lars E. Olsson, Sture Ring, and Sten Ljungkvist *In* NATO Comm. on the Challenges of Mod. Soc. Proc. of the 3d Meeting of the Expert Panel on Air Pollution Modeling 3 Oct. 1972 4 p refs (For availability see N74-34995 24-20)

Attempts are reported to refine the Pasquill-Turner scheme for estimating the degree of dispersion of airborne materials using routine meteorological observations and the Pasquill-Turner stability classes. Preliminary results suggest that improvement could be obtained by including additional variables and possibly also by using different schemes depending on season and time of day. Stepwise regression analysis is now planned to determine which variables should be used in an optimized Pasquill-Turner class scheme. Author

N74-35017 Norwegian Inst. for Air Research, Kjeller.
A THREE-DIMENSIONAL TRANSPORT MODEL FOR AIR POLLUTION IN AN URBAN AREA WITH APPLICATION TO SO2 CONCENTRATION IN OSLO
Knut Erik Gronskei *In* NATO Comm. on the Challenges of Mod. Soc. Proc. of the 3d Meeting of the Expert Panel on Air Pollution Modeling 3 Oct. 1972 39 p refs (For availability see N74-34995 24-20)

A three dimensional transport model for air pollution is applied to the prediction of SO2 concentrations in Oslo. Although Gaussian diffusion formulae had been successfully used in many urban situations. A K-theory model for the complex wind conditions in Oslo is developed because the existence of a convergence zone over the center of the city is well known. The model also recognizes the important influence of the vertical velocity component on the SO2 concentration field. The conservation equation is solved by finite difference methods and the problems encountered with artificial numerical diffusion are noted. Several case studies are presented that give reasonable agreement with observations, even in conditions of weak winds. It is estimated that in Oslo vertical transport associated with organized vertical lifting could account for 40-80% of the SO2 removal from the ground level. Author

N74-35018 NATO Committee on the Challenges of Modern Society.
PROCEEDINGS OF THE FOURTH MEETING OF THE EXPERT PANEL ON AIR POLLUTION MODELING
30 May 1973 246 p refs Proc. held at Oberursel, West Germany, 28-30 May 1973
(Rept-30) Avail: Air Pollution Technical Information Center, Research Triangle Park, N. C. 27711

Brief summaries of several workshop discussions and introductory remarks on air pollution modeling are given. Summaries were also made of several conference papers including pollution control, regional air pollution, air pollution inventories, and user needs. For individual titles, see N74-35019 through N74-35032.

N74-35019 Environmental Protection Agency, Research Triangle Park, N.C. Meteorology Lab.
SUMMARY OF WORKSHOP DISCUSSIONS
K. L. Calder *In* NATO Comm. on the Challenges of Mod. Soc. Proc. of the 4th Meeting of the Expert Panel on Air Pollution Modeling 30 May 1973 38 p (For availability see N74-35018 24-20)

A review was made of air pollution modeling with special emphasis on the following: (1) application of models and user's needs, (2) validation of air quality simulation models, (3) role of regional air pollution studies in model development, (4) role of empirical/statistical modeling of air quality, and (5) complex versus simple air quality models. E.H.W.

N74-35020 Environmental Protection Agency, Washington, D.C.
INTRODUCTORY REMARKS TO WORKSHOP ON APPLICATIONS OF MODELING AND USERS NEEDS
Kay H. Jones *In* NATO Comm. on the Challenges of Mod. Soc. Proc. of the 4th Meeting of the Expert Panel on Air Pollution Modeling 30 May 1973 10 p (For availability see N74-35018 24-20)

A probe was made of the central problem area in the modeler-user relationship - the communications gap. It was determined that the main problem is the user's lack of confidence in the modeler and his output. Several suggestions were made to help eliminate this problem and an effort was made to acquaint the user with the modeling process as a means of increasing his confidence in the finished product. E.H.W.

N74-35021 Freie Univ., Berlin (West Germany).
INTRODUCTORY REMARKS TO THE WORKSHOP SESSION ON VALIDATION OF AIR QUALITY SIMULATION MODELS
H. Fortak *In* NATO Comm. on the Challenges of Mod. Soc. Proc. of the 4th Meeting of the Expert Panel on Air Pollution Modeling 30 May 1973 4 p (For availability see N74-35018 24-20)

A procedure for validating the Bremen modeling process is given. An isoline of mean value was first chosen on which stations were located to represent the structure of the field. These locations were chosen, however, so that they were not especially favourable for the simulation with the model. One station was located near an industrial plant where there was inadequate information about the low level emissions. Another station was located so that it was separated from the center of the city by a large park. A third station was surrounded by a large water area although located in the very center of the city. Then a heating period was chosen (1967/68) in which half-hourly mean values of concentrations were available by measurements and also by simulation computations. A first look showed that the agreement between the two time series was rather poor. However, both ensembles were then formed and the statistics of these ensembles were compared with each other. The agreement between measured and simulated statistical parameters was good for the two stations. The disagreement at the other station showed that the source inventory near the industrial plant was incorrect.
Author

N74-35022 Technische Hochschule, Darmstadt (West Germany).
INTRODUCTORY REMARKS TO THE WORKSHOP SESSION ON THE ROLE OF REGIONAL AIR POLLUTION STUDIES IN MODEL DEVELOPMENT
W. Klug *In* NATO Comm. on the Challenges of Mod. Soc. Proc. of the 4th Meeting of the Expert Panel on Air Pollution Modeling 30 May 1973 5 p (For availability see N74-35018 24-20)

Minimum requirements and the role of regional air pollution studies in the development of pollution models are reported. Data cover: continuous and discontinuous measurements of one or more chemical constituents, source inventory estimates and time variations in source strengths, meteorological data, synoptic and statistical distributions of concentration measurements and meteorological parameters, and information must be obtained for at least one year, preferably for a number of years. It was concluded that the main role of regional pollution studies is to provide relevant data for model development and validation. E.H.W.

N74-35023 Danish Atomic Energy Commission, Risoe.
INTRODUCTORY REMARKS TO THE WORKSHOP SESSION ON THE ROLE OF EMPIRICAL/STATISTICAL MODELING OF AIR QUALITY
N. Busch *In* NATO Comm. on the Challenges of Mod. Soc. Proc. of the 4th Meeting of the Expert Panel on Air Pollution Modeling 30 May 1973 4 p (For availability see N74-35018 24-20)

Three different types of statistical schemes - purley statistical, traditional objective forecast, and analysis by use of empirical/orthogonal functions - used in air pollution studies are outlined. E.H.W.

N74-35024 National Oceanic and Atmospheric Administration, Oak Ridge, Tenn. Atmospheric Turbulence and Diffusion Lab.
INTRODUCTORY REMARKS TO THE WORKSHOP SESSION ON SIMPLICITY VERSUS SOPHISTICATION IN AIR QUALITY MODELING
F. A. Gifford *In* NATO Comm. on the Challenges of Mod. Soc. Proc. of the 4th Meeting of the Expert Panel on Air Pollution Modeling 30 May 1973 3 p (For availability see N74-35018 24-20)

A simple area source diffusion pollution model was developed, tested, and compared to complex models. These comparisons include annual particle pollution mean values, annual and seasonal SO2 and particle urban area pollution patterns down to one hour, time varying CO pollution values up to 48 hours, and photochemical pollutants. Results show that the simple model in all cases compares favorably with more complex models. In most cases the simple model achieves a better correlation with air pollution data. E.H.W.

N74-35025 Ministerium fuer Arbeit, Gesundheit und Soziales, Dusseldorf (West Germany).
COLOGNE EMISSIONS INVENTORY
Werner Figgen, ed. *In* NATO Comm. on the Challenges of Mod. Soc. Proc. of the 4th Meeting of the Expert Panel on Air Pollution Modeling 30 May 1973 47 p (For availability see N74-35018 24-20)

The cologne pilot scheme for establishing an inventory of atmospheric pollutants is discussed. Inventory data cover pollution from domestic heating, vehicles, and industrial sources. Pollution sources are classified according to geographical position and the conditions affecting their emissions: dimension of the source, quantity and temperature of waste gases, nature and quantity of pollution material, and frequency and duration of emission. Inventory data are stored in an electronic data processing system.
Author

N74-35026 Ministerium fuer Arbeit, Gesundheit und Soziales, Dusseldorf (West Germany).
THE ROLE OF DIFFUSION MODELS IN A STRATEGIC CONCEPT FOR AIR POLLUTION CONTROL
Franz Joseph Dreyhaupt *In* NATO Comm. on the Challenges of Mod. Soc. Proc. of the 4th Meeting of the Expert Panel on Air Pollution Modeling 30 May 1973 13 p refs (For availability see N74-35018 24-20)

Various practical applications of modeling ranging from the model inputs to the various uses that are made of the output are presented. Special attention was given to diffusion models and their use in modern strategic concepts for air pollution control.
Author

N74-35027 Technische Uerberwachungs-Verein Rheinland, e.V., Cologne (West Germany).
DISPERSION MODEL USED IN THE COLOGNE REGION
H. Bresser and L. Kropp *In* NATO Comm. on the Challenges of Mod. Soc. Proc. of the 4th Meeting of the Expert Panel on Air Pollution Modeling 30 May 1973 8 p (For availability see N74-35018 24-20)

The use of the dispersion model to control industrial pollution in the Cologne region is revealed. Turbulence due to meteorology and topography was considered in the modeling. Air quality calculations were made of CO, SO2, NO, and organic gases assuming one fixed wind direction, NNW. Two turbulence situations were considered: neutral with a wind speed of 4 m/s, and stable with a wind speed of 2 m/s. E.H.W.

N74-35028 Environmental Protection Agency, Research Triangle Park, N.C. Meteorology Lab.
THE REGIONAL AIR POLLUTION STUDY, UPDATED
Douglas G. Fox and Francis Pooler, Jr. *In* NATO Comm. on the Challenges of Mod. Soc. Proc. of the 4th Meeting of the Expert Panel on Air Pollution Modeling 30 May 1973 31 p refs (For availability see N74-35018 24-20)

Updated plans for the scientific work undertaken in association with the U.S. Environmental Protection Agency's regional air pollution study (RAPS) are given, and the regional air measurement system (RAMS) currently being implemented in St. Louis to collect data required for RAPS is described. Suggestions were made as to how one might proceed to develop necessary models for the pollution study. A comprehensive urban scale pollution model, (WATPC) currently under development is outlined. Author

N74-35029 Environmental Protection Agency, Research Triangle Park, N.C.
USERS NEEDS AND THE APPLICATIONS OF AIR QUALITY SIMULATION MODELS
D. Bruce Turner and Russell F. Lee *In* NATO Comm. on the Challenges of Mod. Soc. Proc. of the 4th Meeting of the Expert Panel on Air Pollution Modeling 30 May 1973 21 p refs (For availability see N74-35018 24-20)

User needs and application of various types of pollution models are described. Data cover concentration of stable pollutants as CO, suspended particulate matter, and SO2, isolated point sources, and multiple source situations of urban areas. The models may be used for short averaging times, on the order of an hour to a day, and for longer seasonal and annual averaging times. E.H.W.

N74-35030 Environmental Protection Agency, Research Triangle Park, N.C.
AIR QUALITY FREQUENCY DISTRIBUTIONS AND METEOROLOGY
Ralph I. Larsen *In* NATO Comm. on the Challenges of Mod. Soc. Proc. of the 4th Meeting of the Expert Panel on Air Pollution Modeling 30 May 1973 15 p refs (For availability see N74-35018 24-20)

Ambient air pollutant concentration frequency distributions are skewed. Various mathematical functions, especially the log normal, were used to describe these skewed distributions. The cumulative frequency distributions of inverse wind speed and pollutant concentration plot as parallel straight lines on lognormal graph paper, confirming that concentration is inversely proportional to wind speed and indicating that the standard geometric deviations for these two variables are the same. Pollutant concentrations calculated with a Gaussian multiple-source urban dispersion model also fit log-normality. Calculated and observed cumulative frequency distributions in one study plotted as parallel straight lines and were within a factor of two of each other for almost all of the 40 sites studied. Author

N74-35031 National Oceanic and Atmospheric Administration, Oak Ridge, Tenn. Atmospheric Turbulence and Diffusion Lab.
THE SIMPLE ATDL URBAN AIR POLLUTION MODEL
F. A. Gifford *In* NATO Comm. on the Challenges of Mod. Soc. Proc. of the 4th Meeting of the Expert Panel on Air Pollution Modeling 30 May 1973 18 p refs (For availability see N74-35018 24-20)

A description is given of the simple urban air pollution model ATDL and some of the experience gained during the application and validation of the model is reviewed. Author

N74-35032 Atmospheric Environment Service, Downsview (Ontario).
REAL-TIME METEOROLOGICAL PREDICTION IN SUPPORT OF AIR-QUALITY CONTROL OPERATIONS IN CANADA
M. Kwizak *In* NATO Comm. on the Challenges of Mod. Soc. Proc. of the 4th Meeting of the Expert Panel on Air Pollution Modeling 30 May 1973 5 p (For availability see N74-35018 24-20)

Data describing the kind of routine meteorological forecast support that can be provided for air pollution episode control activities are reported. Data are also given as to how current programs and plans of the Atmospheric Environment Service relate to such support. Author

N74-35033 Oklahoma Univ., Norman.
CLIMATIC YEAR REGIONS OF THE WESTERN GREAT LAKES STATES Ph.D. Thesis
David Lester Sengenberger 1974 196 p
Avail: Univ. Microfilms Order No. 74-17209

Regional climatic classification systems were devised to classify and regionalize climate into meaningful sets of categories or regions. A modified climatic year methodology was used to test the research hypothesis that climatic year methodology as applied to the Koppen system yields more accurate and detailed climatic regionalization than does the Koppen system when it is based on means. An exhaustive review was made of the development and applications of climatic year methods. This review emphasized the favorable results that other investigators obtained, noted errors that had been made, and traced the evolution of the concepts used in this present work. These concepts included: the use of a climatic year beginning in April; set theory modification of dry climate symbolization; coded climatic classifications noting percentages of annual occurrence; individual element analysis; year-climate mapping; and climatic year regions based on majorities. The area selected for study was the Western Great Lakes States area of Minnesota, Wisconsin, Illinois, Michigan, and Indiana and bordering areas of adjacent states and provinces. Dissert. Abstr.

N74-35034 California Univ., Los Angeles.
THE VALUE OF INFORMATION ON THE MONITORING AND FORECASTING OF AIR POLLUTION Ph.D. Thesis
Gerard Laurence Kernan 1974 236 p
Avail: Univ. Microfilms Order No. 74-21109

Practices of control agencies including the Los Angeles County Air Pollution Control District are examined. The use of indirect methods in measuring network effectiveness were emphasized. A criterion based on the probability of high levels going undetected was developed. The economic benefits from the forecasting and preventing air pollution can be directly measured and the conditions under which a forecast will be of benefit are determined. The monitoring network in Los Angeles was found to be adequate for describing the pollution profile. Monitoring of emissions in the industrial belt in southwest Los Angeles is recommended. Dissert. Abstr.

N74-35035 Texas Technological Univ., Lubbock.
ANALYSIS OF THE WINDOW DAMAGING MECHANISM IN WINDSTORMS Ph.D. Thesis
Joseph Edward Minor 1974 180 p
Avail: Univ. Microfilms Order No. 74-23059

Studies of the behavior of window glass in windstorms have revealed that significant numbers of window glass failures may be attributed to windborne missiles. In addition to detailed discussions of the role of windborne missiles in window failure incidents, the presentation includes (1) an analysis of the character and dynamic properties of the damaging missile, (2) an analysis of window glass response to wind pressure acting in conjuction with missile impact, and (3) a discussion of the innovative process through which results of the investigation must pass in order to reach professional practice. Surveys of 54 rooftops in two urban areas suggested that large quantities of loose gravel present a potential hazard to adjacent glass curtain walls in multistory buildings. Dynamic analyses of the average rock size (0.61 gm) reveal that wind speeds in the 80-120 mph

range can easily lift and propel roof gravel at speeds up to 90 fps 2 cm missile speeds that are well within the range of impact speeds that will break glass. Dissert. Abstr.

N74-35036*# Chicago Univ., Ill. Dept. of Geophysical Sciences.
MESOSCALE WAKE CLOUDS IN SKYLAB PICTURES. Final Report
T. Theodore Fujita and Jaime J. Tecson 1 Aug. 1974 43 p refs Original contains color illustrations
(Contract NAS9-14042)
(NASA-CR-140517) Avail: NTIS HC $5.25 CSCL 04B

The recognition of cloud patterns formed in the wake of orographic obstacles was investigated using pictures from Skylab, for the purpose of estimating atmospheric motions. The existence of ship-wake-type wave clouds in contrast to vortex sheets were revealed during examination of the pictures, and an attempt was made to characterize the pattern of waves as well as the transition between waves and vortices. Examples of mesoscale cloud patterns which were analyzed photogrammetrically and meteorologically are presented. Author

N74-35037*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
WEATHER WATCH STUDIES BY MEANS OF AN OPTICAL TECHNIQUE
Robert E. Turner, ed. Oct. 1974 177 p refs Prepared in cooperation with Colorado State Univ.
(Contract NAS8-21049)
(NASA-TM-X-64885) Avail: NTIS HC $12.00 CSCL 04B

A series of articles is presented on a passive, optical, cross beam system. The passive, optical, cross beam system was evaluated as a remote sensor of atmospheric conditions. The system employed the light scattered from natural aerosols to sense atmospheric mean and turbulent motion. A space-time correlation of the output of two optical sensors was used to evaluate the mean convective wind speed. In approximately 20% of the tests, signal-to-noise levels were sufficient to allow estimation of convective wind speeds. The feasibility of employing intersecting beams to evaluate the atmospheric turbulent motion was also investigated. The intersecting beams produced maximums in the space-time correlation curves for other than zero delay. The non-zero time delay maximums indicate the cross beam system was detecting aerosol layers in the atmosphere, rather than information from the common intersecting volume. For individual titles, see N74-35038 through N74-35044.

N74-35038* Colorado State Univ., Fort Collins.
CROSS BEAM WEATHER WATCH STUDY
V. A. Sandborn *In* NASA. Marshall Space Flight Center Weather Watch Studies by Means of an Optical Tech. Oct. 1974 p 1-29 refs (For availability see N74-35037 24-20)
CSCL 04B

An optical cross beam correlation method has been proposed as a remote measuring system for atmospheric studies. Atmospheric measurements are limited due to the difficulty of placing measuring instruments at the desired location. Although meteorological towers and balloon flights are able to obtain wind data, they are greatly limited in their location. Thus, a real need exists for remote-sensing instrumentation in atmospheric measurements. Previous methods proposed to remotely sense atmospheric conditions include several types of microwave units, acoustic sounders, infrared sensors, optical sensors, and related laser techniques. The evaluation of a simple visible optical technique as a possible remote measuring system is discussed. A feasibility study of field tests of the instrumentation at meteorological sites is reported. Author

N74-35039* Colorado State Univ., Fort Collins.
EXPERIMENTAL PROBABILITY DENSITY DISTRIBUTIONS FOR OPTICAL AND INFRARED CROSS-BEAM UNITS
L. L. Huff and V. A. Sandborn *In* NASA. Marshall Space Flight Center Weather Watch Studies by Means of an Optical Tech. Oct. 1974 p 30-40 refs (For availability see N74-35037 24-20)
CSCL 04B

A series of cross beam experiments for measuring meteorological parameters was conducted. Both optical and infrared sensors were tested for comparison. The test configuration and experiment identification are provided. A data report is presented for an approximate analysis of the probability density distributions of the signals from both the optical and the infared units. Two runs representing each of the two types of cross-beam units were selected for analysis. Probability density functions are also presented for the instantaneous product of the signals for each of the runs. Author

N74-35040* Colorado State Univ., Fort Collins.
ANALOG COMPUTATION OF AUTO AND CROSS-CORRELATION FUNCTIONS
In NASA. Marshall Space Flight Center Weather Watch Studies by Means of an Optical Tech. Oct. 1974 p 41-46 (For availability see N74-35037 24-20)
CSCL 04B

For analysis of the data obtained from the cross beam systems it was deemed desirable to compute the auto- and cross-correlation functions by both digital and analog methods to provide a cross-check of the analysis methods and an indication as to which of the two methods would be most suitable for routine use in the analysis of such data. It is the purpose of this appendix to provide a concise description of the equipment and procedures used for the electronic analog analysis of the cross beam data. A block diagram showing the signal processing and computation set-up used for most of the analog data analysis is provided. The data obtained at the field test sites were recorded on magnetic tape using wide-band FM recording techniques. The data as recorded were band-pass filtered by electronic signal processing in the data acquisition systems. Author

N74-35041* Colorado State Univ., Fort Collins.
PRELIMINARY ANALYSIS OF CROSS BEAM DATA FROM THE GUN BARREL HILL SITE
V. A. Sandborn, A. R. Bice, W. C. Cliff, and B. C. Hablutzel *In* NASA. Marshall Space Flight Center Weather Watch Studies by Means of an Optical Tech. Oct. 1974 p 47-110 ref (For availability see N74-35037 24-20)
CSCL 04B

Preliminary evaluation of cross beam data taken at the Gun Barrell Hill test site of ESSA is presented. The evaluation is made using the analog Princeton Time Correlator. A study of the frequency band width limitations of the Princeton Time Correlator is made. Based on the band width limitations, it is possible to demonstrate that nearly identical correlation is obtained for frequencies from .01 to 3.9 hertz. Difficulty is encountered in that maximums in the correlation curves do not occur at zero time lag for zero beam separations. Author

N74-35042* Colorado State Univ., Fort Collins.
CHECK OUT OF REBUILT OPTICAL CROSS-BEAM UNITS
L. L. Huff, V. A. Sandborn, and K. E. Cary *In* NASA. Marshall Space Flight Center Weather Watch Studies by Means of an Optical Tech. Oct. 1974 p 111-126 (For availability see N74-35037 24-20)
CSCL 04B

Preliminary evaluations of limited cross beam data taken with the rebuilt optical cross beam units at the Gun Barrel Hill Test Site of ESSA are presented. The evaluations were made using the analogue Princeton Time Correlator. A study of these evaluations indicates that the rebuilt units are performing satisfactorily. However, there are indications that, in order to obtain useful information from the cross-correlations, it is essential to make judicious choices of computation time and frequency band pass filtering for the analysis of the data. Author

N74-35043* Colorado State Univ., Fort Collins.
OPTICAL CROSS BEAM FIELD TESTS AT ESSA HASWELL FIELD SITE, OCTOBER 1969
V. A. Sandborn *In* NASA. Marshall Space Flight Center Weather Watch Studies by Means of an Optical Tech. Oct. 1974 p 127-137 (For availability see N74-35037 24-20)
CSCL 04B

A series of tests with both the visible and IR optical cross beam systems was made at the Haswell, Colorado, Field Site of ESSA. This memorandum covers only the details of the test setup and runs. A joint field test program was undertaken by ESSA at a 164 meter (500 foot) meteorological tower. The

tower was instrumented with wind sensors, temperature sensors, temperature sensors, fluctuating wind and temperature sensors and humidity sensors. The sensors were located at three elevations: 42, 192 and 162 meters. A movable elevator was also instrumented and could be positioned at any desired location along the tower height. The main object of the cross beam studies was to compare the visible and IR systems. The instruments were also arranged so that direct comparison with the sensors on the tower can be made. Author

N74-35044* Colorado State Univ., Fort Collins.
ANALYSIS OF CROSS BEAM RUNS TAKEN AT HASWELL FIELD SITE, OCTOBER 1969
L. L. Huff and V. A. Sandborn *In* NASA. Marshall Space Flight Center Weather Watch Studies by Means of an Optical Tech. Oct. 1974 p 138-171 ref (For availability see N74-35037 24-20)
CSCL 04B

A series of cross beam experiments was conducted at the ESSA field site at Haswell, Colorado. Both the optical visual and infrared units were operated on a comparison basis. A data report of the initial auto- and cross-correlation evaluation of these tests is presented. The original test data from the Haswell tests were recorded on F M magnetic tape. A copy of the original tapes was made and employed for the present analysis. The tapes were played back at 60 inches per second for analysis. Some of the infrared units runs (Run Nos. 8,25,40,41,42,43,-44,45) were played back at 30 inches per second in order to gain sufficient averaging time. The averaging time was nominally 3200 seconds real time at 60 inches per second and 1600 seconds real time at 30 inches per second. These averaging times correspond to 100 seconds of averaging time of the correlator. Author

N74-35045# National Environmental Satellite Service, Washington, D.C.
ENVIRONMENTAL SATELLITE IMAGERY, JULY 1974
Aug. 1974 98 p refs
(KMRD-5.4) Avail: NTIS HC $8.00

Daily mosaics are presented for the Northern and Southern Hemispheres. These were prepared from data swaths by a scanning radiometer on the NOAA 2 satellite. Author

N74-35046# Joint Publications Research Service, Arlington, Va.
METEOROLOGY AND HYDROLOGY NO. 7, 1974
2 Oct. 1974 197 p refs Transl. into ENGLISH of Meteorol. Gidrol. (Moscow), no. 7, 1974 p 3-126
(JPRS-63109) Avail: NTIS HC $13.00

Articles on microclimate, agricultural meteorology, weather forecasting, climate control, and hydrological forecasting are presented. For individual titles, see N74-35047 through N74-35070.

N74-35047 Joint Publications Research Service, Arlington, Va.
GLOBAL OBSERVATION SYSTEM. FORECASTING AND EVALUATING CHANGES IN THE STATE OF THE ENVIRONMENT. FUNDAMENTALS OF MONITORING
Yu. A. Izrael *In its* Meteorol. and Hydrol., No. 7, 1974 (JPRS-63109) 2 Oct. 1974 p 1-8 ref Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 7, 1974 p 3-8 (For availability see N74-35046 24-20)

A basis is presented for a global observation (monitoring) system. The system includes observations of the condition of the environment and also observations of the response of the biota caused by variation of this condition. Forecasting and evaluating the existing and predicted state of the environment make it possible to isolate the anthropogenic changes and optimize the human relations to the environment. Author

N74-35048 Joint Publications Research Service, Arlington, Va.
UTILIZING ASYNCHRONOUS OBSERVATION DATA IN THE OBJECTIVE ANALYSIS OF METEOROLOGICAL FIELDS
S. A. Mashkovich and Ye. L. Metelitsa *In its* Meteorol. and Hydrol., No. 7, 1974 (JPRS-63109) 2 Oct. 1974 p 9-19 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 7, 1974 p 9-17 (For availability see N74-35046 24-20)

A procedure is proposed for assimilating asynchronous information based on the method of successive approximations using two point optimal adjustment. Numerical experiments were performed on the basis of the simulated data on the state of the atmosphere. A study was made of two versions of the initial approximation: (1) climatic data, and (2) the smoothed objective analysis field from the aerological observations. Estimates are made of the effectiveness of the developed procedure. Author

N74-35049 Joint Publications Research Service, Arlington, Va.
EXPERIENCE IN USING THE INSTABILITY CRITERION FOR DIAGNOSING AND FORECASTING THE PROCESSES OF SEASONAL AND INTRASEASONAL ADJUSTMENTS IN THE STRATOSPHERE AND MESOSPHERE
A. I. Ivanovskiy and L. A. Ryazanova *In its* Meteorol. and Hydrol., No. 7, 1974 (JPRS-63109) 2 Oct. 1974 p 20-25 ref Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 7, 1974 p 18-22 (For availability see N74-35046 24-20)

The results of calculating the instability criterion are analyzed for which the Richardson number is assumed which is calculated by the magnitudes of the temperature in the 5-80 km layer on the basis of the rocket data from the Kheysa Island and Volgograd stations. A study was made of the variation of the instability criterion as a function of the processes in the stratosphere and mesosphere. Author

N74-35050 Joint Publications Research Service, Arlington, Va.
DIFFERENCES IN CIRCULATION OF THE UPPER ATMOSPHERE IN LOWER LATITUDES OF THE NORTHERN AND SOUTHERN HEMISPHERES
Yu. P. Koshelkov *In its* Meteorol. and Hydrol., No. 7, 1974 (JPRS-63109) 2 Oct. 1974 p 26-32 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 7, 1974 p 23-27 (For availability see N74-35046 24-20)

The difference in intensity of the average circulation in the upper stratosphere to the south and north of the equator is detected. This phenomenon is connected with known peculiarities of the annual behavior of the temperature and pressure in the lower stratosphere above the equator. The proposal was made that there is a dependence of these peculiarities of the structure of the equatorial stratosphere on the large scale processes in the stratosphere of the polar regions. Author

N74-35051 Joint Publications Research Service, Arlington, Va.
SOME SPATIAL CHARACTERISTICS OF CUMULUS CLOUD FIELDS AND RELIABILITY OF THEIR ANALYSIS FROM THE GROUND
A. I. Furman *In its* Meteorol. and Hydrol., No. 7, 1974 (JPRS-63109) 2 Oct. 1974 p 33-39 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 7, 1974 p 28-33 (For availability see N74-35046 24-20)

The data from studying the convective cloud fields during the warm part of the year over the Ukraine and adjacent territories are generalized. Data on the coverage of the sky by clouds according to aircraft and ground observations are compared. It is established that according to ground observations the data are about 20 percent high. The graphs of the recurrence rate of the proportion of cover of the sky by the clouds are presented which are well approximated by the data and gamma distribution. Author

N74-35052 Joint Publications Research Service, Arlington, Va.
EFFECT OF SHELTER BELTS ON THE DUST CONCENTRATION DISTRIBUTION IN DUST STORMS
L. P. Bykova *In its* Meteorol. and Hydrol., No. 7, 1974 (JPRS-63109) 2 Oct. 1974 p 40-49 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 7, 1974 p 34-41 (For availability see N74-35046 24-20)

A quantitative model is proposed for the propagation of dust in developed dust storms considering the decrease in dust concentrations in the plant cover layer. Examples of the effect of forest fields on the dust concentration in the air and the nature of deposition of alluvium are calculated. Author

N74-35053 Joint Publications Research Service, Arlington, Va.
PECULIARITIES OF VERTICAL WIND DISTRIBUTION AND TEMPERATURE UNDER CITY CONDITIONS
O. B. Shklyarevich *In its* Meteorol. and Hydrol., No. 7, 1974 (JPRS-63109) 2 Oct. 1974 p 50-57 refs Transl. into ENGLISH

from Meteorol. Gidrol. (Moscow), no. 7, 1974 p 50-57 (For availability see N74-35046 24-20)

The dynamic and thermal effect of a city on the distribution of meteorological elements is analyzed. Author

N74-35054 Joint Publications Research Service, Arlington, Va.
BIANNUAL CYCLICITY IN THE HYDROLOGICAL PROCESSES OF THE ATLANTIC OCEAN
V. F. Sukhovey *In its* Meteorol. and Hydrol., No. 7, 1974 (JPRS-63109) 2 Oct. 1974 p 58-67 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 7, 1974 p 47-54 (For availability see N74-35046 24-20)

Quasibiannual cycles in the fluctuations of the basic currents in the Atlantic Ocean are studied that occur as a result of displacement of the atmospheric pressure belts also having biannual cyclicity. Although the variation in intensity in the flow system connected with an increase or an attenuation of the baric centers and their geographic position changes the general temperature background of the ocean as a whole little, the intensification of the currents leads to the development in individual areas of local processes characteristic of the area and causing the appearance of significant temperature and salinity anomalies. Author

N74-35055 Joint Publications Research Service, Arlington, Va.
SIMULATION OF HYDROLOGIC CHARACTERISTICS USING MARKOV CHAINS c13
V. I. Babkin and N. K. Serkov *In its* Meteorol. and Hydrol., No. 7, 1974 (JPRS-63109) 2 Oct. 1974 p 68-73 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 7, 1974 p 55-59 (For availability see N74-35046 24-20)

A procedure is discussed for the stochastic simulation of the annual runoff based on the Markov transition probabilities. The probabilities of the runoff transition were obtained according to the data from 85 control stations of the Neman and Pregol' River basins. Author

N74-35056 Joint Publications Research Service, Arlington, Va.
NADYM RIVER ISLANDS c13
A. A. Levashov *In its* Meteorol. and Hydrol., No. 7, 1974 (JPRS-63109) 2 Oct. 1974 p 74-80 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 7, 1974 p 60-65 (For availability see N74-35046 24-20)

The relation of individual types of islands in the Nadym River to the types of channel processes developed in this river is established. Author

N74-35057 Joint Publications Research Service, Arlington, Va.
EFFECT OF THE NEGATIVE COURSE OF WATER EVAPORATION FROM SOIL WITH A DRIED-OUT LAYER c13
Zh.-D. Dandaron *In its* Meteorol. and Hydrol., No. 7, 1974 (JPRS-63109) 2 Oct. 1974 p 81-91 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 7, 1974 p 66-73 (For availability see N74-35046 24-20)

A report is made on the previously unknown phenomenon of the negative behavior of natural water evaporation from soil, with a dried-out layer observed in the second half of the day, for the typical diurnal behavior of the temperature and the air layer next to the ground unsaturated with moisture. Author

N74-35058 Joint Publications Research Service, Arlington, Va.
EFFECT AND AFTEREFFECT OF SPRING FROST ON WINTER WHEAT AS A FUNCTION OF NIGHT TEMPERATURES IN THE FALL AND SPRING c04
V. M. Mokiyevskiy *In its* Meteorol. and Hydrol., No. 7, 1974 (JPRS-63109) 2 Oct. 1974 p 92-98 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 7, 1974 p 74-78 (For availability see N74-35046 24-20)

The resistance of winter wheat to spring frost is basically determined by the temperature conditions of the spring period. The highest resistance to frost is formed in the case of cold nights in the fall and spring, and the least resistance, for warm nights in the fall and spring. The temperature conditions in the spring after the frost predetermine the formation of the final harvest. Low night temperatures promote the formation of a higher yield than high ones. Author

N74-35059 Joint Publications Research Service, Arlington, Va.
SEASONAL FLUCTUATIONS OF THE OCEAN LEVEL c13
O. A. Andreyev, B. A. Kagan, and L. A. Ganesyan *In its* Meteorol. and Hydrol., No. 7, 1974 (JPRS-63109) 2 Oct. 1974 p 99-106 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 7, 1974 p 79-83 (For availability see N74-35046 24-20)

The mean annual distribution of the rises in ocean level constructed by calculation results is presented. The comparison of the theoretically calculated and experimental curves for the annual course of the level deviations from the mean annual values indicates that the time fluctuations of wind circulation in the ocean cannot serve as a cause for the observed seasonal variations in level. Author

N74-35060 Joint Publications Research Service, Arlington, Va.
EFFECT OF HUMAN ACTIVITY ON THE THICKNESS OF SLUSH-AGGLOMERATED ICE ON RESERVOIRS c13
V. V. Piotrovich *In its* Meteorol. and Hydrol., No. 7, 1974 (JPRS-63109) 2 Oct. 1974 p 107-111 Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 7, 1974 p 83-86 (For availability see N74-35046 24-20)

Observational data on reservoirs with cracks in the ice cover, the role of fishing holes in flooding of the ice cover, and the formation of slush-agglomerated ice are reported. It is proved that during the period of loading the ice with snow only individual cracks occur in the ice cover and therefore their participation in the formation of the slush agglomerated ice is insignificant. During the same period, a drilled hole can cause flooding over an area of up to 1 hectare. Therefore, on small reservoirs frequently visited by fishermen, the slush agglomerated ice is appreciably more developed than on a broad reservoir. Author

N74-35061 Joint Publications Research Service, Arlington, Va.
BASIC PRINCIPLES OF THE METHOD OF CALCULATING MINIMUM RUNOFF INCLUDED IN THE SN435-72 c13
A. M. Vladimirov *In its* Meteorol. and Hydrol., No. 7, 1974 (JPRS-63109) 2 Oct. 1974 p 112-115 Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 7, 1974 p 86-88 (For availability see N74-35046 24-20)

The changes taking place in the procedure for calculating the minimum runoff since the time of publication of the SN346-66 [construction norms] are indicated. Author

N74-35062 Joint Publications Research Service, Arlington, Va.
WATER LEVELING OF LAKES c13
Yu. A. Yelshin *In its* Meteorol. and Hydrol., No. 7, 1974 (JPRS-63109) 2 Oct. 1974 p 116-121 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 7, 1974 p 88-91 (For availability see N74-35046 24-20)

During operations performed to grid the chart zero altitudes on Imandra Lake, at a number of other lakes on the Kola Peninsula and also Lake Baykal and Onezhskoye, obvious advantages and high accuracy of water leveling are demonstrated. The possibility of using water leveling to transmit data about the altitude at river stations located near the flow into lakes and reservoirs is indicated. Author

N74-35063 Joint Publications Research Service, Arlington, Va.
PROCEDURE FOR CALCULATING THE JOINT VARIATIONS IN GROUNDWATER RESERVES AND MOISTURE RESERVES OF THE AERATION ZONE c13
A. S. Subbotin *In its* Meteorol. and Hydrol., No. 7, 1974 (JPRS-63109) 2 Oct. 1974 p 122-126 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 8, 1974 p 91-93 (For availability see N74-35046 24-20)

The variation in moisture reserves is considered with variable thickness of the aeration zone caused by fluctuations in the groundwater levels. Formulas are proposed for calculating the variations in groundwater reserves when determining the moisture reserves of the aeration zone to the groundwater level. Author

N74-35064 Joint Publications Research Service, Arlington, Va.
SIGNIFICANCE OF THE DEGREE OF DEVELOPMENT OF WINTER WHEAT IN THE FALL FOR ITS WINTERING AND HARVEST IN THE NORTHERN CAUCASUS, IN THE ROSTOV OBLAST AND IN THE LOWER VOLGA REGION c04
I. V. Svisyuk *In its* Meteorol. and Hydrol., No. 7, 1974

(JPRS-63109) 2 Oct. 1974 p 127-131 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 7, 1974 p 94-96 (For availability see N74-35046 24-20)

The significance of the degree of development of winter wheat in the fall for its wintering and harvest in the Northern Caucasus, Rostov Oblast and Lower Povolzh'ye is demonstrated. Author

N74-35065 Joint Publications Research Service, Arlington, Va.
EFFECT OF WEATHER CONDITIONS ON THE RICE HARVEST IN THE ASTRAKHAN OBLAST **c04**
V. I. But *In its* Meteorol., and Hydrol. No. 7, 1974 (JPRS-63109) 2 Oct. 1974 p 132-136 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 7, 1974 p 96-98 (For availability see N74-35046 24-20)

The statistical interrelations between the deviations of the actual mean oblast rice harvest from the sliding mean harvest and the magnitudes of the meteorological elements are analyzed. It is found that the weather conditions in September have a decisive effect on the magnitude of the given deviations. Author

N74-35066 Joint Publications Research Service, Arlington, Va.
STABILIZED BUOY FOR HYDROMETEOROLOGICAL INSTRUMENTS
V. B. Vaysband, Ye. P. Noskov, and I. S. Podymov *In its* Meteorol. and Hydrol., No. 7, 1974 (JPRS-63109) 2 Oct. 1974 p 137-141 ref Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), No. 7, 1974 p 99-101 (For availability see N74-35046 24-20)

The first experience in the operation of the experimental buoy on the Black Sea as a station for hydrophysical and hydrometeorological measurements is described. Brief information is presented on the design of the buoy, the method of installing it in the sea over a depth of 90 meters and equipment of it with radiotelemetric measuring instruments. Author

N74-35067 Joint Publications Research Service, Arlington, Va.
SUN-TROPOSPHERE PROBLEM
M. N. Gnevyshev *In its* Meteorol. and Hydrol., No. 7, 1974 (JPRS-63109) 2 Oct. 1974 p 142-146 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 7, 1974 p 102-104 (For availability see N74-35046 24-20)

Results of studying the solar tropospheric relations permit a number of conclusions to be drawn which have forecasting interest. The error of those who refute the solar tropospheric relations with insufficient grounds is especially significant since it prevents the development of studies useful in solving the problems of long range weather forecasting. Author

N74-35068 Joint Publications Research Service, Arlington, Va.
CONCERNING THE ARTICLE BY M. N. GNEVYSHEV
S. P. Khromov *In its* Meteorol. and Hydrol., No. 7, 1974 (JPRS-63109) 2 Oct. 1974 p 147-152 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 7, 1974 p 104-105 (For availability see N74-35046 24-20)

The author proposes that solar cycle effects on climate are not proven and that long range forecasts of solar activity of the 11 year cycle lead only to failure because the parameters of solar activity do not reduce to Wolf numbers. G.G.

N74-35069 Joint Publications Research Service, Arlington, Va.
NUMERICAL SIMULATION OF THE ATMOSPHERE AND AUTOMATED METEOROLOGICAL DATA PROCESSING IN THE USA
I. G. Sitnikov *In its* Meteorol. and Hydrol., No. 7, 1974 (JPRS-63109) 2 Oct. 1974 p 153-163 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 7, 1974 p 108-113 (For availability see N74-35046 24-20)

A survey is made of the state of the art with respect to research in numerical simulation of the atmosphere, the statement of an operative project on numerical weather forecasting and automated processing of meteorological data in the U.S.A. Author

N74-35070 Joint Publications Research Service, Arlington, Va.
PHYSICAL PRINCIPLES OF MODIFYING ATMOSPHERIC PROCESSES **c13**
L. G. Kachurin *In its* Meteorol. and Hydrol., No. 7, 1974 (JPRS-63109) 2 Oct. 1974 p 164-168 Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 7, 1974 p 114-116 (For availability see N74-35046 24-20)

A book is discussed in which for the first time an effort has been made successively to investigate the possibilities of modifying weather and climate forming processes. The book is written from the point of view of modern atmospheric physics basically for people having general training within the limits of university courses in physics and mathematics. Author

N74-35071# Committee on Public Works (U. S. Senate).
AIR QUALITY AND AUTOMOBILE EMISSION CONTROL VOLUME 1: SUMMARY REPORT
Washington GPO Sep. 1974 139 p refs Rept. pursuant to S. Res. 135 presented to Comm. on Public Works, 93d Congr., 2d Sess., 2 Aug. 1973 Prepared by the Natl. Academy of Sci. and the Natl. Academy of Eng.
(GPO-39-140) Avail: SOD HC $1.40

Cost/benefit analyses are the focus of the summary statement to Congress which outlines the role of automobile emission in the total U. S. health problem as it is related to air pollution. The effects of transportation-related pollutants on ambient air quality are discussed, and the economic advantages to health, vegetation, and materials derivable improvements in air quality are established. A.A.D.

N74-35072# Committee on Public Works (U. S. Senate).
AIR QUALITY AND AUTOMOBILE EMISSION CONTROL VOLUME 2: HEALTH EFFECTS OF AIR POLLUTANTS
Washington GPO Sep. 1974 158 p refs Rept. pursuant to S. Res. 135 presented to Comm. on Public Works, 93d Congr., 2d Sess., 2 Aug. 1973 Prepared by the Natl. Academy of Sci. and the Natl. Academy of Eng.
(GPO-39-240) Avail: SOD HC $4.35

Panel reports are presented to Congress on the health effects of carbon monoxide, nitrogen oxides, photochemical oxidants and ozone, airborne particles, and sulphur oxides placed in the atmosphere as a result of automotive fuel combustion. The toxicologic effects of the contamination are discussed in terms of physiochemical uptake, cardiovascular response, behavior, and physical exercise, and susceptible populations are identified which are particularly endangered by air pollution, including the embryo, fetus, and newborn infant. The risks imposed on the ecologic system through exposure to excessively high concentrations of environmental pollutants are also described. A.A.D.

N74-35073# Committee on Public Works (U. S. Senate).
AIR QUALITY AND AUTOMOBILE EMISSION CONTROL VOLUME 3: THE RELATIONSHIP OF EMISSIONS TO AMBIENT AIR QUALITY
Washington GPO Sep. 1974 151 p refs Rept. pursuant to S. Res. 135 presented to Comm. on Public Works, 93d Congr., 2d Sess., 2 Aug. 1973 Prepared by the Natl. Academy of Sci. and the Natl. Academy of Eng.
(GPO-39-339) Avail: SOD HC $1.70

Atmospheric transport and dispersion processes, chemical transformations, and natural removal processes are explained in a report to Congress as instrumental in the relationship of automotive exhaust emissions to ambient air quality. Instrumentation, site selection, and data collection and treatment are described as elements in the present monitoring system which yielded estimates of emission rate, location and character of sources, and time distribution of emissions for the major pollutants. Details of an emissions inventory are provided which classify sources of air pollution into the following categories: (1) natural sources; (2) emissions from stationary sources; (3) mobile and transportation sources; and (4) indirect sources. Several predictive models are recommended which relate emissions to ambient air quality for each of the identifiable motor vehicle pollutants. A.A.D.

N74-35074# Committee on Science and Astronautics (U. S. House).
RESEARCH ON SHORT-TERM WEATHER PHENOMENA
Washington GPO 1974 332 p refs Hearings on H.R. 9811 before Subcomm. on Space Sci. and Appl. of Comm. on Sci. and Astronaut., 93d Congr., 1st Sess., No. 23, 6, 7 and 9 Nov. 1973
(GPO-27-402) Avail: Subcomm. on Space Sci. and Appl.

The current state of knowledge of tornadoes and other severe storms, and existing methods of detection, were explored in a Congressional hearing whose witnesses included experts from NOAA and NASA, as well as members of the academic community. The nature and scope of research being conducted on violent atmospheric phenomena is reported, and the adequacy of warning systems for protection of life and property are assessed. The advantages of satellite observation of short term weather phenomena are illustrated in the report of a case study on the characteristics of intense convection associated with tornado vortices, based on photographs taken in April of 1968 by the ATS 3 geosynchronous satellite. Recent advances in satellite capabilities are also described. The activities of the National Severe Storms Forecast Center are reported, and extensive pictures of storms and storm damage are included. A.A.D.

N74-35075# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A MULTILEVEL MODEL OF THE FORECAST OF METEOROLOGICAL ELEMENTS USING COMPLETE EQUATIONS OF HYDROTHERMODYNAMICS AND THE EXPERIMENT OF THE REALIZATION OF THE NUMERICAL DIAGRAM
S. O. Krichak and M. S. Fuks-Rabinovich 24 Jun. 1974 19 p refs Transl. into ENGLISH from Tr. Gidrometeorol. Nauch.-Issled. Tsentr SSSR (Leningrad), no. 100, 1972 p 95-107
(FTD Proj. T74-01-19)
(AD-782552; FTD-MT-24-1111-74) Avail: NTIS CSCL 04/2

The U.S.S.R. translation is devoted to a description of the baroclinic atmospheric model based on the solution to the system of complete equations in adiabatic approximation and to the presentation of some of its test results. GRA

N74-35076# Environmental Protection Agency, Washington, D.C. D.C. Hazardous Materials Advisory Committee.
NITROGENOUS COMPOUNDS IN THE ENVIRONMENT
Dec. 1973 189 p refs
(PB-232959/7; EPA-SAB-73-001; W74-08835) Avail: NTIS MF $2.25; SOD HC $2.20 CSCL 13B

Diverse aspects of municipal and industrial pollutant sources are discussed, including waterborne, atmospheric, and agricultural sources, and industrial processes generating nitrogenous compounds. Attention is given to nitrogenous materials in waste and surface waters, efficiency of sewage treatment, effectiveness of the conventional biochemical oxygen demand test, and the contribution of urban runoff and landfill leakage to the overall nitrogen load in the environment. Concentrations, sources, sinks, the transformation of nitrogenous materials in the lower atmosphere, control measures for stationary and mobile sources, retrofit systems for used cars, and new engine systems are reviewed, along with plant nutrients, fertilizers, and animal wastes. The carcinogenicity of nitrosamines and their precursors is also discussed as a potential danger to health. (Modified author abstract) GRA

N74-35077# Portland General Electric Co., Oreg.
CARTY WEST SITE METEOROLOGY Report, Apr. 1973 - Mar. 1974
Jun. 1974 183 p refs Prepared in cooperation with Meteorology Research, Inc., Altedena, Calif.
(PB-233434/0; PGE-2005) Avail: NTIS HC $5.50 CSCL 04B

Onsite measurements made with an instrumented meteorological tower during the period April 1973 to March 1974 are presented in order to characterize the local and regional meteorology of the Carty West site and its environs. Average and extreme values of meteorological parameters are developed and presented. Atmospheric dispersion factors used to assess the safety and environmental impact of a nuclear plant are derived. Models and results are presented on the environmental impact of the use of Carty Reservoir as a source of plant cooling water. The onsite meteorological measurement program is described and the overall quality of the program is quantitatively discussed. GRA

N74-35078# National Weather Service, Silver Spring, Md. Techniques Development Lab.
A SUBSYNOPTIC UPDATE MODEL AND FORECAST SYSTEM WITH APPLICATION TO AVIATION WEATHER Final Report
Thomas H. Grayson and Robert J. Bermowitz Mar. 1974 54 p refs
(Contract DOT-FA67WAI-131; FAA Proj. 152-461-014)
(AD-783192; FAA-RD-74-100) Avail: NTIS CSCL 04/2

Research and development efforts aimed at improving short range forecasts of weather elements important for aviation interests are described. An objective forecasting system designed to supplement the twelve-hour cycle at The National Meteorological Center (NMC) was modified to give better short range numerical forecasts of sea-level pressure and precipitation. Also added was an analysis-advection scheme that directly provides short range estimates of aviation weather elements. GRA

N74-35079# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
HONEST JOHN MISSILE NO. 214, ROUND NO. 643 RML, 24 MAY 1974 Meteorological Data Report
May 1974 19 p
(DA Proj. 1T6-65702-D-127)
(AD-783466; DR-843) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 13401 Honest John, Missile Number 214, Round Number 643 RML, are presented in tabular form. Author (GRA)

N74-35080# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
LANCE MISSILE NO. 2244, ROUND NO. 226 SCT (23 MAY 1974) Meteorological Data Report
23 May 1974 43 p
(DA Proj. 1T6-65702-D-127)
(AD-783465; DR-842) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 12810 Lance, Missile Number 2244, Round Number 226 SCT, are presented in tabular form. Author (GRA)

N74-35081# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
LANCE MISSILE NO. 2245, ROUND NO. 227 ECL (7 JUNE 1974) Meteorological Data Report
Jun. 1974 34 p
(DA Proj. 1T6-65702-D-127)
(AD-783467; DR-844) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 12810 Lance, Missile Number 2245, Round Number 227 ECL, are presented in tabular form. Author

N74-35082# Brown Univ., Providence, R.I. Dept. of Geological Sciences.
THE DYNAMICS OF NATURAL CLIMATIC CHANGE Semiannual Technical Report, 14 Aug. 1973 - 15 Jun. 1974
John Imbrie, R. K. Matthews, and Thompson Webb, III 17 Jun. 1974 90 p refs
(Contract F44620-73-C-0021; ARPA Order 2299)
(AD-783362; AFOSR-74-1291TR; SATR-2; SATR-3) Avail: NTIS CSCL 04/2

Results of research conducted by ARPA/Brown scientists from 14 August, 1973 to 15 June, 1974 are discussed. Topics covered include: (1) organization of a transfer function conference sponsored by ARPA and CLIMAP; (2) identification of methods to improve paleoclimatic estimates derived from transfer functions; (3) improved coverage of modern pollen data from eastern and central North America; (4) development of a new uplift model for reef terrace sequences; (5) mapping pollen data at 1000 year time-intervals during the Holocene; (6) identification of high-deposition rate cores in the Mediterranean and off Cape Hatteras; (7) significant phase differences occurring in the response times of various parts of the air-sea-ice system during a glacial-interglacial cycle; and (8) completion of the first experiment to test numerical climatic models against synoptic paleoclimatic data. GRA

N74-35083# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
DEVELOPMENT AND CALIBRATION OF THE FORWARD SCATTER VISIBILITY METER Interim Report
H. Stuart Muench, Eugene Y. Moroz, and Leo P. Jacobs 18 Mar. 1974 38 p refs

(AF Proj. 8628)
(AD-783270; AFCRL-IP-217; AFCRL-TR-74-0145) Avail: NTIS CSCL 04/2

A new visibility instrument, the forward scatter visibility meter, has been developed. This report describes the development of the instrument, including the various field tests. Some thirty instruments have been operationally deployed in a network of automatic weather stations near L.G. Hanscom Field in Bedford, Mass. Comparisons between field instruments and transmissometers yield differences of about plus or minus 19 percent. Comparisons with visual observations show differences of plus or minus 34 percent and greater. Analyses of individual cases uncovered difficulties with the response time of observers and with ability to diagnose spatially varying visibility. The accuracy of visibility measurements is assessed and the report concludes by looking at the future of visibility instruments. Author (GRA)

N74-35084# RAND Corp., Santa Monica, Calif.
A NUMERICAL MODEL OF THE GENERAL CIRCULATION OF THE ATMOSPHERE OVER A HEMISPHERE
M. E. Shvets, L. R. Dmitrieva-Arrago, L. N. Magazenkov, L. V. Samoilova, and B. E. Shneerov Mar. 1974 61 p refs Transl. into ENGLISH from TR. Gl. Geofiz. Observ. (Leningrad), v. 256, 1970 p 3-44
(Contract DAHC15-73-C-0181; ARPA Order 189-1)
(AD-782747; R-1384-ARPA) Avail: NTIS CSCL 04/2

The article presents a numerical model of the general atmospheric circulation developed for studies of the genesis of climate. The cloudiness and moisture are determined in the process of integrating the appropriate equations, with evaporation from dry land ignored. Ocean temperatures are derived from observed data, to prevent overburdening the model with equations required to describe the oceanic circulation. The general atmospheric circulation north of the equator is considered for the winter season, although no numerical solutions are shown. GRA

N74-35085# Air Weather Service, Scott AFB, Ill.
AIR WEATHER SERVICE WEATHER MODIFICATION PROGRAM FY 1974 Annual Report
Henry A. Chary, Ronald L. Lininger, and Jesse E. Neyman Jul. 1974 18 p
(AD-782704; AWS-TR-74-254) Avail: NTIS CSCL 04/2

For the first time since AWS actively entered the field of weather modification, no new field projects were undertaken during FY 74. Three cold fog dissipation systems were used operationally (one each at Fairchild AFB, Elmendorf AFB, and Hahn AB). These cold fog dissipation activities assisted 169 aircraft movements which would otherwise have been cancelled, delayed, or diverted by cold fog. Additionally, AWS continued in its active pursuit of a warm fog dissipation system for use at a few select fog-plagued, high-traffic-density bases. Precipitation augmentation and severe storm mitigation received revived interest during FY 74 but no operations or field tests were carried out. (Modified author abstract) GRA

N74-35086# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SIX LEVEL SYSTEM FOR PREDICTING METEOROLOGICAL ELEMENTS USING COMPLETE EQUATIONS FOR A LARGE TERRITORY
L. V. Berkovich 21 Jun. 1974 14 p refs Transl. into ENGLISH from Tr. Tsentr. Nauchn. Issled. Gidrometeorol. (USSR), no. 100, 1972 p 108-116
(AD-782890; FTD-HC-23-2093-74) Avail: NTIS CSCL 04/2

A checkboard grid system of equations was used to make weather forecasts. Problems encountered in using such a system for an entire hemisphere or the earth, including computer time were discussed. The system's use to solve problems of weather forecasts for a period of time up to three days for a large portion of the Northern Hemisphere was reported. Author

N74-35087# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOME NUMERICAL EXPERIMENTS WITH A NONADIABATIC THERMOTROPIC MODEL FOR THE NORTHERN HEMISPHERE
L. S. Gandin, B. M. Ilin, and L. V. Rukhovets 18 Jun. 1974 22 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 286, 1972 p 3-17
(AD-783455; FTD-MT-24-1112-74) Avail: NTIS CSCL 04/2

A simple thermotropic quasi-geostrophic nonadiabatic model of the atmosphere intended for numerical experiments in the forming of a vertically averaged temperature field is described and some results are given of such experiments made with a number of substantial limitations. They include the following: (1) the coefficients of macroturbulent exchange of momentum k and of heat k' are considered to be constants; and (2) inflow of heat to atmosphere M is considered, with one exception, a given function of coordinates corresponding to its average climatic distribution. Author (GRA)

N74-35088# Southwest Research Inst., San Antonio, Tex.
A SURVEILLANCE STUDY OF SMOKE FROM HEAVY DUTY DIESEL POWERED VEHICLES; SOUTHWESTERN USA Final Report
John O. Storment and Karl I. Springer Jan. 1974 290 p refs (Contract EPA-70-109)
(PB-232682/5; SwRI-AR-909; EPA-460/3-74-003) Avail: NTIS HC $17.50 CSCL 13B

The effectiveness of the Federal diesel smoke regulations in controlling smoke emissions from a group of heavy-duty diesel engines engaged in routine automotive service was examined. Trucks and buses, powered by engines certified to meet 1970 smoke standards, were tested for smoke emissions at four-month intervals over a two-year period. Changes in smoke opacity observed during this test period were used to determine, to the extent possible, the effect of time, mileage, and type of service (or duty cycle) on opacity. Baseline brake specific emissions data of unburned hydrocarbons, carbon monoxide, and oxides of nitrogen were also obtained. GRA

N74-35089# Weather Squadron (12th), Ent AFB, Colo.
MAP TYPE CATALOG FOR THE ENGLAND WINDOW
Robert C. Sabin, Richard L. Nieman, and Hal W. Wold Jul. 1974 172 p refs
(AD-783255; Rept-12WS-TP-74-7) Avail: NTIS CSCL 04/2

A standardized procedure was developed to determine the synoptic map types which have occurred over a specified area (window). The map type catalog is a summarization of information relating to these map types for a particular window. (There is a catalog for each of the 14 United States windows, 3 European windows, and 3 Asian windows). The catalog includes characteristics of the map types and listings of each map in the data base (25 years of surface pressure maps) along with its most similar map type. Author (GRA)

N74-35090# RAND Corp., Santa Monica, Calif.
NUMERICAL EXPERIMENTS ON THE COMPUTATION OF GROUND SURFACE TEMPERATURE IN AN ATMOSPHERIC CIRCULATION MODEL Interim Report
Chandrakant M. Bhumralkar May 1974 62 p refs
(Contract DAHC15-73-C-0181)
(AD-783922; R-1511-ARPA) Avail: NTIS CSCL 04/2

The report examines the computation of ground surface temperature in the Rand two-level general circulation model with specific reference to the inclusion of soil heat flux. Comparative results of various numerical integrations are presented to determine the most realistic technique for the computation of the ground surface temperature. It is hoped that this discussion will contribute to the improvement of the accuracy of computed ground surface temperature in the simulation of climatic changes. GRA

N74-35091# RAND Corp., Santa Monica, Calif.
A NUMERICAL EXPERIMENT ON THE EFFECTS OF REGIONAL ATMOSPHERIC POLLUTION ON GLOBAL CLIMATE
L. Randall Koenig Jun. 1974 91 p refs
(Contract DAHC15-73-C-0181; ARPA Order 189-1)
(AD-783510; R-1429-ARPA) Avail: NTIS CSCL 04/2

The report describes the use of a global atmospheric general circulation model to investigate the change in climate caused by the introduction of high concentrations of hygroscopic aerosols into a limited region--roughly, North America. It was postulated that the aerosols would serve as condensation nuclei at lower relative humidity than natural aerosols. The experiment was

run simulating 60 days. Values of meteorological properties during this period were compared with those obtained by a control simulation in which the polluted region was absent. GRA

N74-35092# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
AIRCRAFT EXHAUST POLLUTION AND ITS EFFECT ON THE US AIR FORCE
William S. Blazowski and Robert E. Henderson Aug. 1974 38 p refs Revised
(AD-783828; AFAPL-TR-74-64) Avail: NTIS CSCL 13/2

The report presents information thought to be necessary in establishing an Air Force Policy on aircraft engine pollution. The reasons that different pollutants are emitted is discussed. Relevance of this problem to the Air Force is also investigated. Actions which may be taken to reduce pollutants are presented in terms of technology level: current, mid-term, and advanced technology. Operation, reliability and maintainability, implementation and cost impacts are evaluated for each of the technology levels. The EPA standards and possible use by the Air Force are discussed. Air Force goals, which differ from the EPA standards in method of specification, are developed. These goals will permit control technology application without influencing basic engine design parameters or performance. The cost to meet these goals is established for current AF systems. Author (GRA)

N74-35093# Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie und Geophysik.
METEOROLOGICAL DATA. VOLUME 117, NO. 4: DAILY AND MONTHLY NORTHERN HEMISPHERE 30 MILLIBAR SYNOPTIC WEATHER MAPS OF THE YEAR 1970. PART 4: OCTOBER-DECEMBER Final Report
Krista Hollan, Barbara Kriester, Karin Labitske, Renate Lanschow, and Karin Petzgoldt Jun. 1974 119 p
(Contract DAJA37-72-C-3073; DA Proj. 2M0-61102-B-53B)
(AD-783404) Avail: NTIS CSCL 04/2

The present volume continues the series of stratospheric weather maps published since 1957 in the Meteorologische Abhandlungen of the Meteorological Institute of the Free University. It contains daily height and temperature analysis of constant pressure levels for three months for the whole of the Northern Hemisphere, based on rawinsonde and in the upper stratosphere also on rocketsonde data and performed with the aid of a hydrostatic build-up method. The corresponding monthly mean maps, their variations and deviations are included as well as the mean gridpoint data, calculated from daily values. Moreover, the stratospheric circulation of polar middle, and tropical latitudes is described for the period under consideration. Author (GRA)

N74-35094# Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie und Geophysik.
METEOROLOGICAL DATA. VOLUME 118, NO. 4: DAILY AND MONTHLY NORTHERN HEMISPHERE 10-MILLIBAR-SYNOPTIC WEATHER MAPS OF THE YEAR 1970. PART 4: OCTOBER-DECEMBER Final Quarterly Technical Status Report
Dietrich Just, Barbara Kriester, Karin Labitske, Renate Lanschow, and Karin Petzgoldt Jun. 1974 129 p
(Contract DAJA37-72-C-3073; DA Proj. 2M0-61102-B-53B)
(AD-783403) Avail: NTIS CSCL 04/2

For abstract, see N74-35093.

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N74-35095# Advisory Group for Aerospace Research and Development, Paris (France).
TESTING OF PRECISION INERTIAL GYROSCOPES
Dino A. Lorenzini (Air Force Acad.) Jun. 1974 73 p refs
(AGARD-AG-192; AGARDograph-192) Avail: NTIS HC $6.75

The basic phases of environment, excitation, monitor, and evaluation involved in inertial sensor tests are reviewed. Techniques considered for application to known gyro testing problems are described, and base motion environment, computer-controlled test operation, data acquisition, and data handling problems are identified. The studies suggest that the development of a more comprehensive gyro error model is needed to uncover some of the coefficient disagreements and instabilities which occur between different tests, and different test equipment. Mini-computers are discussed in terms of their advanced capabilities in data acquisition and processing methods for improved test accuracy, speed, and versatility. Author

N74-35096*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AN ATTITUDE CONTROL SYSTEM Patent Application
Charles C. Rupp and George L. VanPragenau, inventors (to NASA)
Filed 2 Oct. 1974 12 p
(NASA-Case-MFS-22787-1; US-Patent-Appl-SN-511346) Avail: NTIS HC $4.00 CSCL 22B

An attitude control system for space vehicle is reported in which angular rate signals are generated by rate gyros mounted closely adjacent to gimbaled engines at the rear of a vehicle, and wherein error signals representative of a commanded change in vehicle angle or attitude are obtained from a precision inertial platform located in the nose region of the vehicle. The rate gyro derived signals dominate at high frequencies where dynamic effects become significant, and platform signals dominate at low frequencies where precision signals are required for a steady vehicle attitude. The blended signals are applied in a conventional manner to control the gimbaling of vehicle engines about control axes. Author

N74-35097# Federal Aviation Administration, Washington, D.C. Flight Services Div.
MINIMUM ENROUTE IFR ALTITUDES OVER PARTICULAR ROUTES AND INTERSECTIONS Semiannual Consolidation of Part 95, Subchapter F
May 1974 218 p
Avail: NTIS HC $14.00

Listings are presented of navigational airways charts indicating the minimum IFR route altitude. The routes covered include: LFR Federal Airways, area navigation routes, VOR Federal Airways, and jet routes. F.O.S.

N74-35098# Technische Universitaet, Brunswick (West Germany).
DIGITAL SYNCHRONIZATION FOR TIME SYNCHRONOUS COLLISION AVOIDANCE SYSTEM IN AVIATION Ph.D. Thesis [DIGITALE SYNCHRONISATION FUER ZEITSYNCHRONE KOLLISIONSSCHUTZSYSTEME IN DER LUFTFAHRT]
Peter Form 1974 127 p refs In GERMAN
Avail: NTIS HC $9.50

The development, characteristics, and operation of a time synchronized air traffic control system for collision avoidance are discussed. The performance of a stationkeeping system which lead to the development of the time synchronized collision avoidance system is analyzed. The ground to air and air to air features of the system are explained. A numerical analysis of the digital synchronization provisions is developed. Diagrams of the typical air traffic control problems are used to explain the theoretical aspects of the system. Transl. by P.N.F.

N74-35099# Aerospace Corp., El Segundo, Calif.
ANALYSIS OF A SINGLE-DEGREE-OF-FREEDOM RATE-INTEGRATING GYRO Technical Report, Jun. 1972 - Nov. 1973
G. H. Neugebauer 15 Mar. 1974 59 p refs
(Contract F04701-73-C-0074)
(AD-781980; TR-0074(4901-03)-4; SAMSO-TR-74-146) Avail: NTIS CSCL 17/7

The effects of asymmetry of design, manufacturing tolerances, and assembly tolerances on the dynamics of a single-degree-of-freedom, rate-integrating gyro are analyzed. The effects of many error sources and the effects of commonly accepted (but frequently erroneous) assumptions on the determination of the performance coefficients are reviewed and analyzed. Statistical analysis procedures for data reduction are not included since they are well covered in the literature. A brief investigation of convection torques due to density gradients in the flotation fluid is included.

Though usually ignored, these convection torques may be very significant in some applications. Author (GRA)

N74-35100# National Aviation Facilities Experimental Center, Atlantic City, N.J.
LONG BEACH, CALIFORNIA, THREE DIMENSIONAL, VISUAL FLIGHT RULES, GENERAL AVIATION AIRPORT STUDY Final Report
W. Robert McCosker and Leo J. Mulry Apr. 1974 53 p
(FAA Proj. 013-601-020)
(AD-778924; FAA-NA-74-2; FAA-RD-74-40) Avail: NTIS HC $3.25

During a three hour survey period in July 1973, 235 aircraft of 39 mixed types made 514 point-to-point and local airport flights to or from the Long Beach Airport, California. These flights represented a normal general aviation flight day for this location during the preferred flying season of the year. The survey data presented in this report are one facet of an effort to obtain comprehensive, real life, three dimensional traffic samples of flight activity for the construction of air traffic models. GRA

N74-35101# Air Defense Weapons Center, Tyndall AFB, Fla.
ADC/ADWC TEST PROJECT 74-05, F-106 STANDBY COMPASS RELOCATION PROJECT
1974 22 p
(AD-783369) Avail: NTIS CSCL 01/4

The overall objective of this test program was to install and evaluate the Tyndall Solution to the F-106A clear top canopy standby magnetic compass problem. GRA

N74-35102# Airborne Instruments Lab., Farmingdale, N.Y.
FEASIBILITY MODEL OF LANDING PERFORMANCE MONITOR Final Report
George W. Morton 1 Apr. 1974 99 p refs
(Contract DOT-FA72WA-2840)
(AD-783191; AIL-A026-1; FAA-RD-74-79) Avail: NTIS CSCL 17/7

A dual-level, four-wavelength, L-band interferometer was designed and constructed to demonstrate the feasibility of precisely monitoring and recording the path followed by aircraft on ILS approach. This is accomplished by the application of passive RF interferometry techniques to track the source of the DME interrogation signals radiated by existing airborne radio navigation equipment. The design specifications and performance characteristics of the breadboard equipment are described, as well as methods for converting observed RF phase data into conical space angle. Two series of flight tests were conducted with the breadboard model. The initial tests at Republic Airport demonstrated qualitatively the validity of the concept and provided operational experience. In a second series of tests at Atlantic City, New Jersey (NAFEC), quantitative comparisons were made between optical tracking theodolite measurements of conical angle and those derived from the RF phase measurements. (Modified author abstract) GRA

N74-35103# Aerospace Corp., El Segundo, Calif. Systems Engineering Operations.
GEOMETRIC PERFORMANCE OF THE GLOBAL POSITIONING SYSTEM Final Report
A. H. Bogen Jun. 1974 111 p
(Contract F04701-73-C-0074)
(AD-783210; TR-0074(4461-02)-2; SAMSO-TR-74-169) Avail: NTIS CSCL 17/7

The report is intended to identify and evaluate some of the factors affecting the Global Positioning System navigation performance for the satellite configurations, as well as system design issues related to the orbital geometry. The report addresses the user visibility, ground station visibility, satellite-induced Doppler, geometric dilution of precision, selection of satellites for optimum navigation conditions, and satellite eclipses. The levels of nominal geometric performance which can be achieved are established Author (GRA)

N74-35104# Ohio Univ., Athens. Dept. of Electrical Engineering.
SQUARE WAVE VOR Final Report, Jul. 1971 - Oct. 1972
R. W. Redlich Jul. 1974 160 p refs
(Contract DOT-FA71WA-2664)
(AD-783252; FAA-RD-74-127) Avail: NTIS CSCL 17/7

The report presents results of theoretical and experimental study of a new type of VOR, which has been named Square Wave VOR (SVOR) because its variable phase waveshape is roughly square. Two experimental SVORs have been built and tested. The second one was built under FAA contract and was extensively ground and flight tested at both NAFEC and Ohio University. Results of these tests are reported. Tests of a number of receivers for compatibility with SVOR signals were made, and the results are presented. A theoretical and experimental investigation of VOR and SVOR errors caused by Doppler shift in a multipath carrier is included. A feasibility study of a wide aperture SVOR designed for a 13 times reduction in multipath is presented. Author (GRA)

N74-35105# Intermetrics, Inc., Cambridge, Mass.
CIRIS TRANSPONDER DEPLOYMENTS FOR TESTING INERTIAL NAVIGATION SYSTEMS Final Report
William S. Widnall and Richard T. Ku 13 Aug. 1974 215 p refs
(Contract F29601-73-C-0089; AF Proj. 688G)
(AD-783638; IR-89-74; AFSWC-TR-74-22) Avail: NTIS CSCL 17/7

The completely integrated reference instrumentation system (CIRIS) system at Holloman Air Force Base provides a highly precise reference for the flight testing of navigation and guidance systems. CIRIS subsystems include an inertial navigation system (INS), a Doppler velocity sensor, and a precision ranging system. This report evaluates the effect of the deployment of the transponders of the precision ranging system on CIRIS position/velocity/attitude accuracy and on the estimation of sources of error in an INS under test. Position accuracy with basic two and three transponder deployments is explored with a simple position fix error analysis. Position/velocity/attitude accuracy for a variety of multi-transponder deployments is evaluated using the CIRIS post-flight processor on simulated CIRIS flight data. The performance improvement with Doppler data is presented. (Modified author abstract) GRA

N74-35106# Naval Postgraduate School, Monterey, Calif.
DESIGN STUDY OF AN AVIONICS NAVIGATION MICRO-COMPUTER M.S. Thesis
William Lowell McCracken Jun. 1974 177 p refs
(AD-783868) Avail: NTIS CSCL 17/7

A microcomputer program to solve the complex task of air-borne navigation was developed to demonstrate the practicality of replacing costly general purpose digital computers with relatively inexpensive dedicated microcomputers on-board naval aircraft. The microcomputer program showed that microcomputers have sufficient speed and accuracy to solve the navigation problem. In order to overcome the microcomputer's major deficiencies, speed and accuracy, special arithmetic subprograms based on table look-up were developed to trade inexpensive memory for more speed. An application of graph theory in the form of process graphs was made to facilitate the development and documentation of the navigation program. To aid in the testing of the microcomputer program a FORTRAN simulation program was developed to confirm the results of an error bound analysis of the navigation program. Author (GRA)

N74-35107# Illinois Univ., Urbana. Radio Research Lab.
A CROSS CORRELATION METHOD FOR COMPUTER-AIDED SELECTION OF CDAASUM PATTERNS
S. Smith, Albert D. Bailey, Edward W. Ernst, and Chester S. Gardner Jul. 1974 68 p refs
(Contract N00014-67-A-0305-0002)
(AD-783708; UILU-ENG-74-2549; RRL-Pub-450; TR-48) Avail: NTIS CSCL 17/3

A circularly disposed antenna array/radio direction finding (CDAA/RFD) system (Wullenweber) can be used to determine the azimuthal angle of arrival for an incoming signal. Unfortunately, there will always be a certain degree of inaccuracy in the resulting value since not all arriving signals will be perfect single-mode data. This report deals with one possible method of determining when to accept the angle-of-arrival value computed from a SUM pattern of the CDAA. Filtering and cross-correlating the data with an ideal pattern are performed. The resulting cross-correlation

coefficient gives a value upon which an acceptance or rejection decision can be made. Author (GRA)

N74-35108# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
BASIC PROBLEMS IN THE DEVELOPMENT OF A LASER GYROSCOPE
V. V. Bogdanov, V. G. Brykov, V. I. Matrosov, A. V. Mochalov, and D. K. Mynbaev 27 Jun. 1974 13 p refs Transl. into ENGLISH from Izv. Elektrotekhn. Inst. (Leningrad), v. 69, no. 101, 1972 p 69-74
(AD-783576; FTD-HT-23-1205-74) Avail: NTIS CSCL 17/7

The properties of laser gyroscopes are discussed. The laser gyroscope is a ring gas laser whose resonator is formed by mirrors while amplification is provided by a tube with the active element. A numerical analysis of the accuracy obtainable with the laser gyroscope is developed. The possibility of using the Zeeman effect for static displacement of the gyroscope performance curve is analyzed. It is concluded that for the creation of a laser gyroscope it is necessary to have stabilization of the parameters of the device, the development of technical means for stabilizing and controlling the processes in an active medium, a reduction and stabilization of the capture zone, and improvement of the existing methods as well as development of new methods for shifting the instrument performance curve. Author

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology; and 29 Space Radiation.

N74-35109 Carnegie-Mellon Univ., Pittsburgh, Pa.
BRAGG DIFFRACTION FROM STANDING ACOUSTIC WAVES WITH APPLICATIONS TO ULTRAHIGH DATA RATE OPTICAL COMMUNICATIONS SYSTEMS Ph.D. Thesis
Shi-Kay Yao 1974 181 p
Avail: Univ. Microfilms Order No. 74-20496

Acousto-optic Bragg interactions involving lossy standing acoustic waves have been studied both theoretically and experimentally in this thesis. When an electric signal of proper frequency is applied to a piezoelectric transducer which is attached to one end face of an acoustic resonator block, standing acoustic waves are generated in the resonator. The standing acoustic waves can be used to sequentially gate a laser pulse train when the laser beam is incident upon the standing acoustic waves at Bragg condition. An optical multiplexing/demultiplexing device entitled Standing Wave Ultrasonic Bragg Cell (abbreviated as SUBC) based on the above principle was constructed and tested. Dissert. Abstr.

N74-35110 California Univ., San Diego.
TRANSFER FUNCTIONS IN GRADIENT INDEX OPTICS Ph.D. Thesis
William Eugene Martin 1974 354 p
Avail: Univ. Microfilms Order No. 74-22204

Two principle areas on the subject of gradient index optics the generation of and the selection of the best refractive index profile distributions for optical imagery. A brief summary was presented of ray tracing in media containing refractive index gradients that rederives the work of previous investigators in a more powerful manner. Such derivations include the index profile that exactly focuses parallel rays. A compact derivation for the index profile that ideally focuses helical skew rays was also given. Three reference refractive index profiles chosen for transfer function analysis are parabolic, hyperbolic, and the helical. The generation of refractive index profiles by diffusion is examined theoretically for simple diffusion processes in a semi-infinite body, a slab, and a cylinder. Dissert. Abstr.

N74-35111 Texas Technological Univ., Lubbock.
OPTICAL MEASUREMENTS OF HIGH ELECTRIC AND MAGNETIC FIELDS Ph.D. Thesis
James Elton Thompson 1974 179 p
Avail: Univ. Microfilms Order No. 74-23069

Conventional electrical methods of measuring high electric and magnetic fields are subject to induced noise and calibration difficulties and are not capable of conveniently determining spatial field distributions. The Kerr effect is used in conjunction with analyzers which produce the equivalent of infinite fringe and finite fringe interferograms indicative of the electric fields in a parallel plate arrangement. The Faraday effect is used in conjunction with other analyzers to determine interferometrically temporal and spatial magnetic field distributions in a high field flux concentrator and a high energy theta pinch device. The complete theory of the analysis schemes is presented using the Poincare sphere representation technique for motivation and qualitative analysis and Jones calculus for quantitative results. Unique areas of applicability for these techniques are also presented. Dissert. Abstr.

N74-35112*# Towne (Robin M.) and Associates, Inc., Seattle, Wash.
ACOUSTIC MEASUREMENT STUDY 40 BY 80 FOOT SUBSONIC WIND TUNNEL Final Report
Apr. 1974 269 p refs
(Contract NAS2-7759)
(NASA-CR-137573) Avail: NTIS HC $16.50 CSCL 20A

An acoustical study conducted during the period from September 1, 1973 to April 30, 1974 measured sound pressure levels and vibration amplitudes inside and outside of the subsonic tunnel and on the tunnel structure. A discussion of the technical aspects of the study, the field measurement and data reduction procedures, and results are presentd, and conclusions resulting from the study which bear upon near field and far field tunnel noise, upon the tunnel as an acoustical enclosure, and upon the sources of noise within the tunnel drive system are given. Author

N74-35113*# Optronic Labs., Inc., Silver Spring, Md.
LONG TERM SPECTRAL IRRADIANCE MEASUREMENTS OF A 1000-WATT XENON ARC LAMP
William E. Schneider [1974] 13 p ref
(Contract NAS1-13194)
(NASA-CR-132533) Avail: NTIS HC $3.00 CSCL 09E

Spectral irradiance measurements over the range of 200 to 1060 nm were made on a 1000-watt xenon arc lamp over a period of 1500 hours. Four sets of measurements were made after periods of 70, 525, 1000, and 1500 hours of operation. The lamp (Hanovia Compact Xenon Arc Lamp) was mounted in the NASA Solar Irradiation System. When used in the System, the lamp is used as the radiating source for six test stations. Measurements were made of both the longterm stability (or variation of spectral irradiance as a function of time) and the actual spectral irradiance incident on the test specimen. Author

N74-35114*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
A PERTURBATION ANALYSIS OF THE PROPAGATION AND INSTABILITY OF WAVES IN DUCTS WITH VARYING CROSS SECTIONS Final Report, 1 Sep. 1972 - 31 Aug. 1974
Ali Hasan Nayfeh 31 Aug. 1974 9 p refs
(Grant NGR-47-004-109)
(NASA-CR-140401; VPI-E-74-27) Avail: NTIS HC $4.00 CSCL 20A

All publications and presented speeches are listed that discuss the various aspects of perturbed wave propagation and noise generation in ducts with varying cross sections. G.G.

N74-35115*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SPINNING MODE SOUND PROPAGATION IN DUCTS WITH ACOUSTIC TREATMENT
Edward J. Rice 1974 36 p refs Presented at 88th meeting of the Acoust. Soc. of Am., St. Louis, 5-8 Nov. 1974
(NASA-TM-X-71613; E-8140) Avail: NTIS HC $3.25 CSCL 20A

A detailed theoretical study of the acoustic propagation of spinning modes in acoustically treated open circular ducts is described. The suppressor with splitter rings was modeled by using the rectangular approximation to the annular duct. The theoretical models were used to determine optimum impedance and maximum attenuation for several spinning lobe numbers

from 0 to 50. Some interesting results of the analysis are that for circular ducts the maximum possible attenuation and the optimum wall impedance are strong functions of the lobe number. For annular ducts the attenuation and optimum wall impedance are insensitive to the spinning lobe number for well cut-on modes. The above results help explain why suppressors with splitter rings were quite effective in spite of the lack of detailed information on the noise source modal structure. Author

N74-35116*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INTERIM PREDICTION METHOD FOR JET NOISE
James R. Stone [1974] 91 p refs
(NASA-TM-X-71618; E-8112) Avail: NTIS HC $4.00 CSCL 20A

A method is provided for predicting jet noise for a wide range of nozzle geometries and operating conditions of interest for aircraft engines. Jet noise theory, data and existing prediction methods was reviewed, and based on this information a interim method of jet noise prediction is proposed. Problem areas are idenified where further research is needed to improve the prediction method. This method predicts only the noise generated by the exhaust jets mixing with the surrounding air and does not include other noises emanating from the engine exhaust, such as combustion and machinery noise generated inside the engine (i.e., core noise). It does, however, include thrust reverser noise. Prediction relations are provided for conical nozzles, plug nozzles, coaxial nozzles and slot nozzles. Author

N74-35117*# National Committee for the International Commission for Optics, Washington, D.C.
SPACE OPTICS
B. J. Thompson, ed. and R. R. Shannon, ed. Apr. 1974 833 p refs Presented at the Intern. Congr. of the Intern. Comm. for Optics, 9th, Santa Monica, Calif., 9-13 Oct., 1972
(Contract NSR-09-012-105)
(NASA-CR-140173; ISBN-0-309-02144-8; PB-23694/0) Avail: NTIS CSCL 20F

This is a state-of-the-art report of the important field of space optics through late 1972. It presents 47 of the technical papers prepared by experts in various parts of the field for the Ninth International Congress of the International Commission for Optics. General categories include space systems, ultraviolet instruments, infrared methods, communications and radiometry, thin films, image processing and holography, optical technology, optical methods, and instrumentation. GRA

N74-35118*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AEROACOUSTICS
Marvin E. Goldstein Washington 1974 440 p refs
(NASA-SP-346) Avail: NTIS HC $9.00 CSCL 20A

An analysis was conducted to determine the properties of sound generated by aerodynamic forces or motions originating in a flow, such as the unsteady aerodynamic forces on propellers or by turbulent flows around an aircraft. The acoustics of moving media are reviewed and mathematical models are developed. Lighthill's acoustic analogy and the application to turbulent flows are analyzed. The effects of solid boundaries are calculated. Theories based on the solution of linearized vorticity and acoustic field equations are explained. The effects of nonuniform mean flow on the generation of sound are reported. Author

N74-35119*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
FLUCTUATING SURFACE PRESSURE CHARACTERISTICS ON SLENDER CONES IN SUBSONIC, SUPERSONIC, AND HYPERSONIC MACH-NUMBER FLOW Final Report
Hanno H. Heller and Anthony R. Clemente Washington NASA Oct. 1974 81 p refs
(Contract NAS1-9559)
(NASA-CR-2449) Avail: NTIS HC $4.00 CSCL 20D

A program is presented to determine the flow-induced unsteady aerodynamic loads on space-shuttle orbiter configurations in the early reentry phase. Experiments on 8 degree half-angle cone/flat-base configurations were conducted at free-stream Mach numbers of 6 and 15 and Reynolds numbers corresponding to shuttle reentry. Data are available at free-stream Mach-numbers of 0.67, 2.5, 3, 4, 6, 15, and 22. It is shown that empirical expressions could be developed for the Mach-number dependence of the overall fluctuation pressure under an attached turbulent boundary layer and under a separated base-flow region. Author

N74-35120*# Tennessee Univ., Knoxville. Dept. of Electrical Engineering.
THE APPLICATION OF IMAGE ENHANCEMENT TECHNIQUES TO REMOTE MANIPULATOR OPERATION Final Report
R. C. Gonzalez Sep. 1974 78 p refs
(Contract NAS8-29271)
(NASA-CR-120478; TR-EE/CS-74-15) Avail: NTIS HC $7.00 CSCL 20F

Methods of image enhancement which can be used by an operator who is not experienced with the mechanisms of enhancement to obtain satisfactory results were designed and implemented. Investigation of transformations which operate directly on the image domain resulted in a new technique of contrast enhancement. Transformations on the Fourier transform of the original image, including such techniques as homomorphic filtering, were also investigated. The methods of communication between the enhancement system and the computer operator were analyzed, and a language was developed for use in image enhancement. A working enhancement system was then created, and is included. Author

N74-35121# Ecole Polytechnique Federale de Lausanne (Switzerland).
FORMATION OF HELICODIAL INSTABILITY IN A SCREW PINCH MEASURED BY MEANS OF MAGNETIC DIPOLAR COIL [FORMATION DE L'INSTABILITE HELICOIDALE D'UN SCREW-PINCH MESUREE AU MOYEN DE SONDES MAGNETIQUES DIPOLAIRES]
A. Pochelon and R. Keller Jul. 1974 44 p refs In FRENCH; ENGLISH summary
(LRP-86/74) Avail: NTIS HC $5.25

The deformation of a screw-pinch plasma column is investigated with pairs of magnetic dipole coils placed along the axis. The influence of on-axis electrodes on the longitudinal current, which gives well-known boundary conditions, is studied in a normal mode development. Measurements of displacement and helical torsion are consistent with the optical data obtained from streak camera photographs. The role of the model used in the interpretation of the results is shown clearly. Author

N74-35122# Avco-Everett Research Lab., Everett, Mass.
OPTICAL INTERFERENCE PHENOMENON Final Report, 1 Sep. 1971 - 31 Jul. 1973
C. W. VonRosenberg, Jr., Daniel W. Trainor, and Andrew Lowenstein Feb. 1974 80 p refs
(Contract DNA001-72-C-0007; ARPA Order 1433)
(AD-782275; DNA-3239F) Avail: NTIS CSCL 07/4

Experimental measurements of the formation of vibrationally excited ozone resulting from O + O2 yields O3(+) = M, M = O2, N2 are reported. The bulk rate constant and the exothermicity of the reaction going into various vibrational states of ozone are given. The rate for vibrational relaxation O3(+) + M yields O3 + M was also measured. Separate experiments on the absorption of CO2 9.6 micron laser lines by ozone are described as well as a measurement of CO2 (v sub 3) relaxation by ozone.
Author

N74-35123# California Inst. of Tech., Pasadena.
SOLUTIONS TO PROBLEMS IN STATIC AND DYNAMIC ELECTRICITY Final Report
William R. Smythe Jun. 1974 187 p refs
(PB-232797/1; WRS-1893-7-5) Avail: NTIS HC $5.40 CSCL 20C

A complete set of solutions is reported of the 679 problems posed in the third edition of Static and Dynamic Electricity, (McGraw-Hill, 1968). Of the problems, 581 also appeared in the second edition (1950). The solutions are keyed to both editions. This book has become a classic reference for engineers and physicists working on problems involving electrostatic and magnetostatic potential theory, boundary values, eddy currents, antennas, wave guides, cavity resonators, and the diffraction of electromagnetic radiation. A significant fraction of its reference

value resides in the very large collection of problems, solutions to which are presented here. Also included is an extensive errata list for the third edition, first printing. GRA

N74-35124# Cambridge Collaborative, Inc., Mass.
PREDICTION AND CONTROL OF RAIL TRANSIT NOISE AND VIBRATION: A STATE-OF-THE-ART ASSESSMENT Interim Report, Jul. - Dec. 1973
J. E. Manning, R. G. Cann, and J. J. Fredberg Apr. 1974 252 p refs
(Contract DOT-TSC-643)
(PB-233363/1; UMTA-MA-06-0025-74-5; DOT-TSC-UMTA-74-6) Avail: NTIS HC $6.50 CSCL 13B

The report contains results of a review of current technology for the prediction and control of urban rail transit noise and vibration, with primary emphasis on the parameters affecting propagation paths. Included are tools for the prediction of wayside noise and vibration adjacent to both atgrade and elevated transit track, groundborne noise propagation from subway tunnels, and noise in cars and in stations. In addition, several noise and vibration control techniques are evaluated including resilient rail fasteners, floating slabs, noise barriers, elevated structure enclosures, structural damping, and acoustical treatment of stations and tunnels. GRA

N74-35125# Naval Electronics Lab. Center, San Diego, Calif.
FIBER-OPTIC DATA BUS Final Report, Apr. 1973 - Feb. 1974
E. A. Howard and D. H. Marcus 29 Apr. 1974 37 p refs
(NR-Proj. 288-001; WF54545603)
(AD-782661; NELC-TR-1921) Avail: NTIS CSCL 20/6

Information transfer requirements of three aircraft platforms are investigated to determine the applicability of fiber optics to naval aircraft data bus systems for the 1975-1980 time frame. Multiplex systems and data bus designs proposed for these platforms by industry sources are examined and this data is utilized as a base to project the characteristics of the near future fiber-optic data bus system. The major factors of data bus design, control mechanizations of command/response and polling are compared. Techniques for implementing the fiber-optic data bus system and associated problems with the alternative approaches are presented. Star coupler and couple: configurations are discussed. Author (GRA)

N74-35126# North Carolina Univ., Chapel Hill.
CRITICAL PHENOMENA AND LIQUID HELIUM Final Report, 15 Aug. 1971 - 31 Dec. 1973
Oscar K. Rice 31 Jul. 1974 9 p refs
(Grants DA-ARO(D)-31-124-G145; DA-ARO(D)-31-24-G669; DA-ARO(D)-31-124-70-G21)
(AD-783381; AROD-3091-29-C) Avail: NTIS CSCL 20/13

Research on the following topics is reported: (1) energy fluctuations and rotons in liquid helium; (2) Landau's theory of liquid helium; (3) the motion of a sphere in a perfect fluid; (4) the fundamental laws of thermodynamics and statistical mechanics; (5) interatomic forces in and thermodynamic properties of solid argon; melting phenomena in simple solids; (6) thermodynamics and statistical mechanics of critical lines and critical points, with applications to He-3/He-4 mixtures, binary liquid systems, and pure substances; (7) experimental work on coexistence curves in binary liquid systems, and experimental and theoretical work on the effect of impurities; and (8) experimental equipment for temperature control. Author (GRA)

N74-35127# Army Foreign Science and Technology Center, Charlottesville, Va.
POSSIBILITIES AND LIMITATIONS OF SCHEMATIZED MODELS OF INFRARED BANDS
L. N. Bogdanova and M. V. Podkladenko 12 Apr. 1974 11 p refs Transl. into ENGLISH from Zh. Prikl. Spektrosk. (USSR), v. 16, no. 1, Jan. 1972 p 119-123
(AD-782089; FSTC-HT-23-471-74) Avail: NTIS CSCL 07/4

A standardized method of calculating the emissivity of gases for determining the absorption function for any absorbing layers and any pressures in the temperature range 300-2500K is presented. It is based on schematized models of infrared bands. GRA

N74-35128# Naval Electronics Lab. Center, San Diego, Calif.
THE EFFECTS OF CONTAMINANTS ON FIBER OPTIC CONNECTOR RADIATION PATTERNS
G. Kosmos 25 Jul. 1974 19 p ref
(NELC Proj. F228)
(AD-783691; NELC-TD-349) Avail: NTIS CSCL 20/6

The study of how liquid contaminants affect transmission within fiber connectors in installing fiber optic systems has shown that fiber optic connectors which are contaminated by oils and grease generally enhance light transmissions, thus eliminating one of the objections to fiber optic communications. It was found that some of the contaminants that attenuate transmission are opaque and that they can be removed from the connector during normal maintenance. Author (GRA)

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N74-35129 Colorado Univ., Boulder.
SPECTRAL LINE FORMATION IN SPHERICALLY SYMMETRIC AND EXPANDING ATMOSPHERES Ph.D. Thesis
Paul Belknap Kunasz 1974 233 p
Avail: Univ. Microfilms Order No. 74-22364

Spectral line formation is studied in static and radially flowing, spherically symmetric atmospheres. For some frequencies in the line, the ratio or photon mean free path to radius of curvature is large. The static case was solved with a generalization of the variable Eddington factor method. The radiation field changed greatly in character as the extension of the atmosphere increased from the plane-parallel limit to the infinite-radius limit. A modification of the Feautrier technique was used for the problem of radially expanding or contracting atmospheres. The combined effects of spherical extension and radial flows were studied for low and moderate velocity fields in a variety of models. In optically thick models, in which photons were generated through collisional excitation, emergent intensity and flux profiles were shifted to the red due to the effect of the Doppler displacement on the monochromatic optical thicknesses of rays passing through the atmosphere. Dissert. Abstr.

N74-35130*# Pittsburgh Univ., Pa. Dept. of Physics.
DISSOCIATION OF CH4 BY ELECTRON IMPACT: PRODUCTION OF METASTABLE HYDROGEN AND CARBON FRAGMENTS
T. G. Finn, B. L. Carnahan, and E. C. Zipf Aug. 1974 33 p refs
(Grant NGL-39-011-030; Contract DA-31-124-ARO(D)-440; ARPA ORDER 826)
(NASA-CR-140179; SRCC-209) Avail: NTIS HC $4.75 CSCL 20H

Metastable fragments produced by electron impact excitation of CH4 have been investigated for incident electron energies from threshold to 300 eV. Only metastable hydrogen and carbon atoms were observed. Onset energies for the production of metastable hydrogen atoms were observed at electron impact energies of 22.0 + or - .5 eV, 25.5 + or - .6 eV, 36.7 + or - .6 eV and 66 + or - 3 eV, and at 26.6 + or - .6 eV for the production of metastable carbon atoms. Most of the fragments appear to have been formed in high-lying Rydberg states. The total metastable hydrogen cross section reaches a maximum value of approximately 1 X 10 to the minus 18th power sq cm at 100 eV. At the same energy, the metastable carbon cross section is 2 x 10 to the minus 19th power sq cm. Author

N74-35131*# Stanford Univ., Calif. Dept. of Chemistry.
EXPERIMENTS ON THE ORIGIN OF MOLECULAR CHIRALITY BY PARITY NON-CONSERVATION DURING BETA-DECAY
William A. Bonner 1973 24 p refs Presented at the Intern. Symp. on Generation and amplification of asymmetry in chem. systems, Julich, West Germany, 24-26 Sep. 1973

(Grant NGL-05-020-582)
(NASA-CR-140161) Avail: NTIS HC $4.25 CSCL 20H

Experiments are described to test a theory for the origin of optical activity wherein the longitudinally polarized electrons resulting from parity violation during radioactive beta decay, and their resulting circularly polarized Bremsstrahlung, might interact asymmetrically with orgainic matter to yield optically active products. Experiments involve subjecting a number of racemic and optically active amino acid samples to irradiation in a 61700 Ci90SR-90Y beta radiation source for a period of 1.34 years, then examining them for any asymmetric effects by means of optical rotatory dispersion and analytical gas chromatography. In the cases of D,L-leucine, norleucine, norvaline and proline as solids, of D,L-leucine in solution and of D,L-tyrosine in alkaline solution no optical rotation was observed during CRD measurements in the 250-630 nm spectral region. While slight differences were noted in the percent radiolysis of solid D- (12.7%) and L-leucine (16.2%) as determined by GC, no enrichment of either enantiomer was found. Author

N74-35132*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
BIREFRINGING ARISING FROM THE REORIENTATION OF THE POLARIZABILITY ANISOTROPY OF MOLECULES IN COLLISIONLESS GASES
C. H. Lin, J. P. Heritage, T. K. Gustafson, R. Y. Chiao, and J. P. McTague [1974] 63 p refs Submitted for Publication Prepared in cooperation with Calif. Univ., Berkeley
(Grant NGR-05-003-559)
(NASA-TM-X-70344) Avail. NTIS HC $6.25 CSCL 20H

The refractive index change in a collisionless gas is evaluated from the Stark shifts of the rotational energy levels that arise from the polarizability anisotropy. For the limit of an extremely short-duration excitation, a multilevel coherent effect resulted in delayed refractive index bursts. Both stationary and transient responses of this birefringence to an optical field were considered for symmetric top molecules, with particular emphasis on the special case of linear molecules. Author

N74-35156 Princeton Univ., N.J.
NUCLEONICS
W. G. Price, Jr. *In its* A Fusion Power Plant Aug. 1974 p 164-216 refs (For availability see N74-35146 24-25)

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N74-35133 Rice Univ., Houston, Tex.
APPLICATION OF PLASMA KINETIC THEORY TO AURORAL BIRKELAND CURRENTS Ph.D. Thesis
Chung-An Lin 1974 211 p
Avail: Univ. Microfilms Order No. 74-21299

The theory of plasma instability near the plasma frequency is applied to explain certain high-frequency modulations observed in an aurora arc by a sounding rocket payload designed to investigate the relationship between Birkeland currents associated with an auroral arc and energetic particles. High frequency modulations in fluxes of kilovolt electrons were observed, and comparison with data from the Chatanika radar indicates that these modulations were close to the local plasma frequency. It appears that the observed oscillations can be interpreted in a consistent way as the nonlinear development of a classical gentle-bump instability. The reduced (parallel) distribution functions are determined from the differential fluxes j measured by channeltron particle detectors. Two approaches to computing the growth rates are presented. Dissert. Abstr.

N74-35134 Texas Technological Univ., Lubbock.
CO2 LASER REFRACTION AND HEATING EFFECTS IN A MAGNETIZED PLASMA COLUMN Ph.D. Thesis
George Marshall Molen 1974 97 p
Avail: Univ. Microfilms Order No. 74-23060

The interaction of a CO2 laser beam with a magnetized 200 nsec FWHM pulse followed by a 1 micro sec tail is fired along the axis of a high density, low temperature, annular plasma immersed in a .33 T axial magnetic field. The hydrogen plasma is produced by a linear discharge between ring electrodes spaced 35 cm apart. The radial density distribution has an on-axis minimum immediately after its formulation; however, the dip is soon filled in by diffusion processes. Peak electron densities of 3 x 10 to the 22 power/cu m and temperatures up to 2 eV are measured. The refracted laser beam patterns are recorded on developed photographic film targets for various delays after the initiation of the plasma current. For small delays, the collimated laser beam is focused by the plasma to a small intense spot. The spot size is in reasonable agreement with calculations using the eikonal equation with the measured density gradients. Dissert. Abstr.

N74-35135 New Hampshire Univ., Durham.
INTERRELATIONSHIP OF ENERGETIC PARTICLES, PLASMA AND MAGNETIC FIELDS IN THE INNER HELIOSPHERE Ph.D. Thesis
Jerome Theodore Nolte 1974 216 p
Avail: Univ. Microfilms Order No. 74-21096

This study of energetic solar particles, solar wind plasma and magnetic fields in the inner heliosphere divides naturally into two parts. One part is a study of the solar corona, and the other is an investigation of energetic particle propagation in the interplanetary medium, based on recent reports of measurements of highly anisotropic solar particle fluxes. Coronal magnetic field structure is investigated through the use of solar and interplanetary magnetic polarity measurements, and observations of solar wind plasma and energetic particles during the first eight months of 1965. The means of investigation is a cross-correlation of chromospheric with high coronal magnetic polarity. The high coronal polarity is deduced from observations of the interplanetary magnetic field and solar wind plasma. Dissert. Abstr.

N74-35136# Joint Publications Research Service, Washington, D.C.
INJECTION OF ELECTRONS AND CONFINEMENT OF PLASMA IN MULTIGAP ELECTROMAGNETIC TRAP
O. A. Lavrentyev, V. A. Sidorkin, V. P. Goncharenko, and Yu. S. Azovskiy Oak Ridge, Tenn. AEC Oct. 1974 11 p refs Transl. into ENGLISH from the Russian report KHFTI-74-3
(AEC-TR-7562; KHFTI-74-3) Avail: NTIS HC $4.00

A multigap electromagnetic trap with one annular slot was used to investigate the magnetic field produced by counter-connected coaxial coils in a plasma generated as a result of the ionization of residual gas, and confined by a system of external magnetic and electric fields. The electron lifetime was determined as a function of the parameters of the trap and ion temperature. Author

N74-35137*# Stanford Univ., Calif. Inst. for Plasma Research.
SOLAR PHYSICS - PLASMA PHYSICS WORKSHOP
P. J. Baum (Calif. Univ., Riverside), J. M. Beckers (Sacramento Peak Obs.), C. E. Newman (St. Andrews Univ.), E. R. Priest (Harvard Coll. Obs.), H. Rosenberg (High Altitude Obs.), D. F. Smith (Maryland Univ.), P. A. Sturrock, and D. G. Wentzel Oct. 1974 35 p ref Meeting held at Stanford, Calif., 17-20 Sep. 1974
(Grant NGL-05-020-272; Contract N00014-67-A-0112-0062) (NASA-CR-140571; SU-IPR-594) Avail: NTIS HC $4.75

A summary of the proceedings of a conference whose purpose was to explore plasma physics problems which arise in the study of solar physics is provided. Sessions were concerned with specific questions including the following: (1) whether the solar plasma is thermal or non-themal; (2) what spectroscopic data is required; (3) what types of magnetic field structures exist; (4) whether magnetohydrodynamic instabilities occur; (5) whether resistive or non-magnetohydrodynamic instabilities occur; (6) what mechanisms of particle acceleration have been proposed; and (7) what information is available concerning shock waves. Very few questions were answered categorically but, for each question, there was discussion concerning the observational evidence, theoretical analyses, and existing or potential laboratory and

N74-35138# Nagoya Univ. (Japan). Inst. of Plasma Physics.
FAST AIR GAP CROWBAR SWITCH DECOUPLED BY A LOW PRESSURE GAP
Shiro Kitagawa and Kei-ichi Hirano Apr. 1974 26 p refs
(IPPJ-T-20) Avail: NTIS HC $4.50

A fast pressurized crowbar gap switch, in which a low pressure gap is used as a nonlinear decoupler, is investigated. The switch is composed of a simple two electrode high pressure gap and a low pressure gap of trigatron type. A special trigger circuit is designed in order that a single pulse breaks down the high- and low-pressure gaps successively. The jitter of breakdown time is less than 20 nsec over the wide range of the operating conditions: Working voltage and pressures in both gaps. The switch is disigned for 40 kV operation and its inductance is 22 nH. Seventy switches of this type are installed in a 40 kV, 210 kJ fast capacitor bank. Up to now they have been running successfully for 8000 shots with little maintenance. Author

N74-35139# Nagoya Univ. (Japan). Inst. of Plasma Physics.
THEORY AND EXPERIMENT ON RF PLUGGING OF MAGNETICALLY CONFINED PLASMA IN AN OPEN-ENDED SYSTEM
Tetsuo Watari, Shinji Hiroe, Teruyuki Sato, and Setsuo Ichimaru Apr. 1974 59 p refs
(IPPJ-191) Avail: NTIS HC $6.00

The theory of an RF plugging of a magnetically confined plasma in an open-ended system is presented; it takes explicit account of the collective effect brought about by the dynamic screening action of the plasma. The theory predicts a maximum efficiency of the RF plugging at an optimum frequency corresponding to a zero of the longitudinal dielectric constant. The plugging efficiency is calculated as a function of the plasma density, the strength of the RF field, and the intensity of the magnetic field. These theoretical predictions are compared with the experimental observations, demonstrating a satisfactory agreement in overall features. Results provide a useful scaling law associated with the concept of the RF confinement. The theory also offers an adequate explanation for the discrepancy between experimental values of the optimum frequency and those predicted by a conventional theory based on an individual particle model.
Author

N74-35140# Nagoya Univ. (Japan). Inst. of Plasma Physics.
CONCEPT FOR A DOUBLE CUSP FUSION REACTOR WITH THE ADIABATIC RF PLUGGING
Tadatsugu Hatori Jun. 1974 34 p refs
(IPPJ-192) Avail: NTIS HC $4.75

RF plugging scheme is proved to be efficient enough when it is applied to a cusp system, and a possible prototype of a fusion reactor is sketched. The proposed system is composed of two cylindrically symmetric cusp geometries and a long central section, of about 100 m, connecting them. In the line and the point cusp regions an RF field with the frequency of the order of the ion cyclotron frequency is applied to suppress the end loss. This scheme has high purity advantage over the toroidal systems. The frequency of the RF field is properly set so that the RF barrier reflects only deuterons and tritons and is insensitive to heavy impurity ions in the low ionization stage. Author

N74-35141# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ON THE FAST ION HEATING OF PLASMA
Kenji Watanabe and Kyoji Nishikawa Jun. 1974 20 p refs
(IPPJ-193) Avail: NTIS HC $4.00

A critical survey is given about experimental results on anomalously fast ion heating, including the linear turbulent heating experiment and others, which are said to have close correlation with the plasma turbulences. Results may not be explained consistently in terms of only the plasma turbulence, usually considered so far. A comment, suggesting another mechanism of fast ion heating, namely the turbulent macroscopic process is given. It is associated with a macroscopic motion of plasma, or an instability of long wavelength fluctuations, which was set in as a result of the change of plasma parameters of discharge column, the parameter change being originated from the usual high frequency short wavelength plasma instabilities. Author

N74-35142# Nagoya Univ. (Japan). Inst. of Plasma Physics.
NONLINEAR SKIN EFFECT OF HIGH POWER MICROWAVE INCIDENT ON A COLLISIONLESS MAGNETIZED PLASMA
K. Minami, K. P. Singh, M. Masuda, and K. Ishii Aug. 1974 32 p refs
(IPPJ-194) Avail: NTIS HC $4.75

Experimental results are presented which verify a nonlinear skin effect of high power microwaves incident on a collisionless, uniform plasma having a sharp boundary. The skin depth, observed by microwave reflection techniques, increases with the incident microwave power. The results are compared with the theoretical analysis in which the radiation pressure due to electromagnetic field is taken into account. Author

N74-35143# Nagoya Univ. (Japan). Inst. of Plasma Physics.
AN ORIENTABLE SECONDARY EMISSION DETECTOR FOR PLASMA EXPERIMENTS
C. Deck, H. Iguchi, J. Jacquinot, and T. Kawabe May 1974 18 p refs
(IPPJ-T-21) Avail: NTIS HC $4.00

An orientable secondary emission detector is described. Its response to the fast neutral atom flux emitted by a plasma allows the measurement of the density profile, the phase space distribution function and the average energy of the plasma ions.
Author

N74-35144*# Colorado State Univ., Fort Collins. Dept. of Electrical Engineering.
THEORETICAL INVESTIGATIONS ON PLASMA PROCESSES IN THE KAUFMAN THRUSTER Annual Report
H. E. Wilhelm Sep. 1974 73 p refs
(Grant NGR-06-002-147)
(NASA-CR-140521) Avail: NTIS HC $6.75 CSCL 20I

An analysis of the sputtering of metal surfaces and grids by ions of medium energies is given and it is shown that an exact, nonlinear, hyperbolic wave equation for the temperature field describes the transient transport of heat in metals. Quantum statistical and perturbation theoretical analysis of surface sputtering by low energy ions are used to develop the same expression for the sputtering rate. A transport model is formulated for the deposition of sputtered atoms on system components. Theoretical efforts in determining the potential distribution and the particle velocity distributions in low pressure discharges are briefly discussed. Author

N74-35145*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SELF-ENERGIZED PLASMA COMPRESSOR Patent Application
Edward L. Shriver and Eduard B. Igenbergs, inventors (to NASA) (NAS-NRC) Filed 27 Aug. 1974 12 p
(NASA-Case-MFS-22145-2; US-Patent-Appl-SN-500982) Avail: NTIS HC $4.00 CSCL 20I

A self-energized plasma compressor which compresses plasma discharged from a coaxial plasma generator is described. The device includes a helically shaped coil which is coaxially aligned with the center axis of the generator. The plasma generator creates a current through the helical coil, which, in turn, generates a time varying magnetic field that produces a force which acts radially upon the plasma. The coaxial plasma generator and helical coil move the plasma under high pressure and temperature to the narrow end of the coil. Beads are positioned adjacent to the narrow end of the coil, and are accelerated to hypervelocities by the plasma, thereby simulating meteoroids.
NASA

N74-35146# Princeton Univ., N.J. Plasma Physics Lab.
A FUSION POWER PLANT
R. G. Mills, ed. Aug. 1974 588 p refs
(Contract AT(11-1)-3073; Grant NSF GP-579)
(MATT-1050) Avail: NTIS HC $32.50

The technical features and advantages of electric power plants based on plasma fusion principles are discussed. The characteristics of plasmas and the problems of plasma control are analyzed. The operating cycle of a fusion power plant is explained. The subjects discussed include the following: (1) the diverter and vacuum system, (2) fuel injection, (3) magnetics, (4) choice of materials for the reactor, (5) heat transfer and energy conversion systems, (6) hazards, (7) environmental compatibility, and (8)

maintenance, repair, and overhaul of the reactor. For individual titles, see N74-35147 through N74-35168.

N74-35147 Princeton Univ., N.J.
INTRODUCTION
R. G. Mills *In its* A Fusion Power Plant Aug. 1974 p 1-9 refs (For availability see N74-35146 24-25)

Background information on the development of plasma fusion reactors is provided. A diagram of the requirements on the size and field strenght required for stellarators to produce a given amount of electric power is developed. The conceptual design of a fusion power plant is explained to show the interrelation of high temperature metals, high efficiency thermodynamic systems, and ideal plasma behavior. The assumptions involved in developing a plasma fusion reactor are identified as: (1) transport properties of reactor grade plasma, (2) methods of injecting fuel into a reacting plasma, (3) heating and ignition procedures, (4) performance of plasma divertors, and (5) the rate of embrittlement and useful lifetime of the first vacuum wall in the neutron flux.
Author

N74-35148 Princeton Univ., N.J.
SUMMARY OF TECHNICAL FEATURES **c03**
R. G. Mills *In its* A Fusion Power Plant Aug. 1974 p 10-19 refs (For availability see N74-35146 24-25)

The electric plant described in this report produces 2030 MW of electric power for sale. The nuclear heat generated is 5305 MW. The overall net efficiency is 38%. The gross electric efficiency is 45.3%. The generators produce 2405 MW of electricity of which 375 is used within the plant, primarily for circulating the helium gas coolant. A chart of these characteristics, together with a large number of other operating parameters, is presented for quick reference. A detailed drawing of the plant is presented. The primary fuels consumed within the reacting plasma are deuterium and tritium. Although an initial inventory of about 3 kg of tritium is required in order to begin operations, subsequent needs for tritium will be met by generating it from lithium in the lithium-beryllium-fluoride salt (flibe) present in the blanket. At full power, 1.1 kg of lithium will be consumed per day, but since the blanket contains over 160,000 kg of lithium, it may be several years before any lithium need be added to the blanket. This lithium need not be considered as a fuel but more as a maintenance and renewal expense in servicing the facility. The deuterium fuel requirements (0.35 kg per day) may be met by the purchase of heavy water. Daily consumption of D2O will be about 1.76 kg which should cost less than eighty dollars.
Author

N74-35149 Princeton Univ., N.J.
ADVANTAGES OF FUSION POWER **c03**
P. Bonanos *In its* A Fusion Power Plant Aug. 1974 p 20-23 ref (For availability see N74-35146 24-25)

The application of nuclear fuels for power production is discussed. The major advantage of fusion power is the essentially inexhaustible and cheap fuel supply. The total mass of fuel consumed in a 2000 MWe plant is small, less than 2 kg/day, and fuel costs are estimated to be less than 0.02 mill/kWh. Deuterium gas is presently extracted from water in commercial quantities at reasonable cost. For D-T reactors the tritium is not available naturally and must be bred within the plant. Lithium is naturally abundant. Total reserves are not accurately known because easily available surface sources such as western United States lake brines represent many centuries' use at current consumption rates.
Author

N74-35150 Princeton Univ., N.J.
PLASMA CHARACTERISTICS AND CONTROL
J. L. Johnson (Westinghouse Res. Labs.) and S. L. Gralnick *In its* A Fusion Power Plant Aug. 1974 p 24-39 refs (For availability see N74-35146 24-25)

The problems that guide the choice of plasma properties, the specific parameters chosen, and a few options available for plasma control are discussed. For a steady-state plasma, the energy entering or produced by nuclear reactions in any volume element must just equal that lost by diffusion, convection, heat conduction, and radiation. Unless this condition is satisfied, the plasma will cool and the reaction will go out, or the temperature of the plasma will increase. This generalization of the Lawson criterion imposes serious restrictions on the choice of the plasma parameters. Two specific problems associated with this are a need for an enhancement of plasma diffusion over that predicted by classical models and for control of the plasma temperature. The first arises from the fact that if a significant fraction of the fuel reacts before it has diffused through the system and the resulting helium is well confined, a major part of the magnetic pressure would be used to contain the ash. Similarly, left on their own, the electrons would tend to get too hot and exert too much pressure on the confining magnetic field. Thus, a given externally imposed field could not contain as many reacting ions, and the reactor economics would suffer.
Author

N74-35151 Princeton Univ., N.J.
THE OPERATING CYCLE **c03**
S. L. Gralnick *In its* A Fusion Power Plant Aug. 1974 p 40-74 refs (For availability see N74-35146 24-25)

The operating cycle of the Princeton Reference Design Fusion Reactor is discussed. A design based on a long pulse tokamak - the pulse length is much longer than the residence time of the particles in the system is proposed. Consequently, fuel injection is provided, and a divertor is used to remove the reaction products (alpha particles) and unburnt fuel. In this manner, the plasma parameters are maintained constant during the extended pulse. The operating cycle of this design employs a 100 minute burning pulse and a current shutdown and reignition procedure that occupies less than 3 minutes. This provides a duty factor, defined as the ratio of the time during which power is produced to the total time of 97%. During the downtime the electrical load on the station is satisfied by withdrawing thermal energy from the molten salt (flibe) in the reactor blanket and storage areas, and consequently electrical power is delivered without interruption or load shedding. In this sense this design is a steady state power reactor.
Author

N74-35152 Princeton Univ., N.J.
THE DIVERTER AND VACUUM SYSTEM **c03**
F. H. Tenney and G. Lewin *In its* A Fusion Power Plant Aug. 1974 p 75-125 refs (For availability see N74-35146 24-25)

The magnetic field of the reference reactor consisting of a toroidal field and a poloidal field is discussed. These fields are axisymmetric and result from current flow in a set of suitable coils and in the plasma. The poloidal field that passes near the discharge is indicated. It is characterized by two types of field lines: (1) type A, confined to the volume of the discharge, and (2) type B which extends from near the discharge to regions far from the discharge. The field line separating the regions of these two types of poloidal field lines is called the separatrix line. The separatrix line contains a null point of the poloidal field. The shape of the separatrix line surrounding the discharge volume was designed to approximate a circle of given minor radius located at a given major radius. The total magnetic field of the reference reactor is obtained by adding the toroidal field to the poloidal field. The resulting field lines lie on surfaces of revolution about the axis of symmetry generated by the poloidal field lines.
Author

N74-35153 Princeton Univ., N.J.
FUEL INJECTION
S. L. Gralnick *In its* A Fusion Power Plant Aug. 1974 p 126-137 refs (For availability see N74-35146 24-25)

The long pulse mode of tokamak reactor operation which requires the maintenance of a quasi-steady fuel ion density profile (constant in time for periods much longer than particle containment times) is analyzed. This is accomplished by injecting an appropriate mixture of deuterium, tritium and impurity additive (argon) atoms to replace those that are consumed by fusion reactions and those lost by diffusion out of the system. To do this the technique of high velocity ballistic injection of solidified fuel is used. Although deep penetration of the reactor plasma is a formidable technical task, it is within the realm of plausibility. Alternative, yet to be explored, schemes relying on edge-deposited fueling may relieve this problem. Pellet injection has two advantages over its principal competitor, high energy neutral beam injection: (1) less energy is required to achieve the same fuel mass penetration, and (2) the pellet evaporation process inhibits the formation of energetic charge-exchange neutrals, which

are likely to be a major problem in fueling schemes relying on neutral atom injection. Author

N74-35154 Princeton Univ., N.J.
MAGNETICS **c03**
U. R. Christensen *In its* A Fusion Power Plant Aug. 1974 p 138-147 (For availability see N74-35146 24-25)

The broad aspects of the magnetic configuration of the Princeton Reference Design Fusion Reactor are presented. The magnetics are divided into the toroidal field and poloidal field systems. The toroidal confinement field is a fundamental parameter of the reactor. Its magnitude must be as high as technologically possible. It is planned to use superconducting coils for this purpose. Detailed characteristics of the toroidal field are reported. The poloidal field consists of three coils. The coils provide the following functions: (1) an axial or vertical field that holds the plasma torus in equilibrium, (2) guiding the diverted field lines through the divertor, and (3) providing for a constant change of flux during the operating phase which in turn produces a toroidal field within the plasma to overcome the IR drop. Author

N74-35155 Princeton Univ., N.J.
CHOICE OF MATERIALS **c03**
F. H. Tenney *In its* A Fusion Power Plant Aug. 1974 p 148-163 refs (For availability see N74-35146 24-25)

The factors affecting the choice of materials to be used in the construction of the Princeton Reference Design Fusion Reactor are analyzed. The decision to use stainless steel is explained. The design scheme for breeding tritium is described. The cooling systems for the toroidal magnetic field are examined to justify the use of helium as the cooling agent. Questions of swelling of the stainless steel, the choice of a superconductor for the toroidal magnetic field, and the choice of shield materials are investigated. Author

N74-35156 Princeton Univ., N.J.
NUCLEONICS **c24**
W. G. Price, Jr. *In its* A Fusion Power Plant Aug. 1974 p 164-216 refs (For availability see N74-35146 24-25)

The production of neutrons and methods for controlling neutrons in the Princeton Fusion Reactor Reference Design are discussed. The primary problems involve obtaining neutron energy for the power cycle, protection of the plant and operators from the radiation load, and production of tritium fuel to be consumed in the plasma within the plant by neutron-induced transmutations. The components of the reactor which are involved in controlling the neutrons are described and their operation is explained. A schematic drawing of the reactor is provided to show the nature and extent of the materials used in the reactor. The characteristics of the neutron flux spectra within the reactor are displayed by charts and graphs. A cost analysis of the operation of the reactor with various nuclear fuels is developed. Author

N74-35157 Westinghouse Electric Corp., Pittsburgh, Pa.
HEAT TRANSFER AND ENERGY CONVERSION SYSTEMS **c33**
P. W. Davison and K. C. Sokolosky (New England Elec. System) *In* Princeton Univ. A Fusion Power Plant Aug. 1974 p 217-290 refs (For availability see N74-35146 24-25)

The process of converting the energy produced in the plasma of a fusion reactor into electrical energy is discussed. Emphasis is placed on the reactor heat transfer systems. The physical characteristics of the reactor coolant system are tabulated. Heat transfer equations and mathematical models are provided to analyze the thermodynamic properties of the reactor. Methods and materials for protecting the components of the reactor from high temperature effects are explained. Author

N74-35158 Princeton Univ., N.J.
THE VACUUM WALL, RADIATION DAMAGE, STRUCTURAL PROBLEMS **c03**
P. Bonanos and H. K. Perkins *In its* A Fusion Power Plant Aug. 1974 p 291-322 refs (For availability see N74-35146 24-25)

The radiation damage and structural problems associated with the operation of a fusion reactor are discussed. The prediction of fusion reactor materials behavior and properties is an extrapolation of effects observed in fission reactor irradiation experiments and supportive ion and electron bombardment studies. The major differences between fusion and fission reactor materials performance are explained. The specific problems which are covered are: (1) the neutronic spectral effects, (2) first wall effects, (3) bulk radiation effects, and (4) ductility loss and creep. Sputtering yield data for various reactor materials are shown in tables and graphs. Author

N74-35159 Princeton Univ., N.J.
SUPERCONDUCTING MAGNETS AND CRYOGENIC SYSTEMS **c03**
J. File *In its* A Fusion Power Plant Aug. 1974 p 323-361 refs (For availability see N74-35146 24-25)

The superconducting magnets and the cryogenic system of the Princeton Reference Design Fusion Reactor are discussed. The superconducting magnets operate at temperatures below 20 degrees K and require a cryogenic cooling system. The design criteria and the refrigeration requirements for each component of the system are analyzed. Materials and equipment for the various systems and components are recommended. Schematic drawings of the magnets are provided. Malfunctions of the reactor involving the loss of one or two of the magnets are examined. Procedures for starting and operating the reactor are explained. Author

N74-35160 Princeton Univ., N.J.
FUEL HANDLING **c03**
E. F. Johnson *In its* A Fusion Power Plant Aug. 1974 p 362-410 refs (For availability see N74-35146 24-25)

The fuel flows throughout the fusion power reactor and the processing sequences that are necessary to maintain a reactor feedstock of adequate purity while assuring on the one hand self-sufficiency in respect to the tritium fuel and on the other reasonable control of tritium losses to the environment are discussed. The principal fuel flows are shown as three major loops, namely, the primary fuel loop, the coolant helium loop, and the breeder salt loop. In the primary fuel loop the reactor feed materials, deuterium, tritium, and argon, are circulated continuously through the reactor along with small amounts of helium and protium ash. Both ash species are removed continuously in the course of condensing the primary fuel stream. In the breeder salt loop most of the tritium generated from the lithium in the salt is stripped out as tritium fluoride and recovered in cold traps. The small fraction of the tritium generation that is not stripped out permeates into the coolant helium, where it is recovered as water. Author

N74-35161 Argonne National Lab., Ill.
TRITIUM DISTRIBUTION AND LEAKAGE **c03**
Victor A. Maroni *In* Princeton Univ. A Fusion Power Plant Aug. 1974 p 411-431 refs (For availability see N74-35146 24-25)

The distribution and leakage profiles for tritium in the reference design model are discussed. These profiles are determined by the technical features and, have an important bearing on the operational characteristics of the reference model. The results presented in this chapter make a substantial contribution to the evaluations of the system features (hazards, environmental impact, operational procedures, maintenance, and cost analysis). In addition to the environmental considerations, there are other potentially significant consequences of the tritium in fusion reactors, and they too must be assessed. These include holdup of tritium in the structure, accelerated corrosion and loss of mechanical integrity due to hydriding, and assorted maintenance problems. Author

N74-35162 Westinghouse Electric Corp., Pittsburgh, Pa.
HAZARDS **c05**
P. W. Davison *In* Princeton Univ. A Fusion Power Plant Aug. 1974 p 432-457 refs (For availability see N74-35146 24-25)

The major systems of the Princeton Reference Design Fusion Reactor are reviewed from the point of view of identifying the hazards associated with normal and abnormal operation. Engineered safeguards and operational procedures are identified for eliminating the hazards or minimizing their consequences. The most serious credible accident is identified as the design basis accident and the design requirements specified for assuring that the consequences of that accident will not exceed the

regulatory limits for accident conditions. Data are provided to show the maximum allowable levels of radiation and radioactive materials for normal reactor operation. It is concluded that the fusion power plant can be operated without any significant hazards to the public or plant personnel during normal operation. For most modes of abnormal operation, hazards to the public are not significant if the recommended safety procedures are instituted. Author

N74-35163 Westinghouse Electric Corp., Pittsburgh, Pa.
ENVIRONMENTAL COMPATIBILITY **c03**
P. W. Davison *In* Princeton Univ. A Fusion Power Plant Aug. 1974 p 458-476 refs (For availability see N74-35146 24-25)

Studies were conducted to determine the environmental implications of the construction and operation of a fusion power plant. Examples of environmental studies are provided. It is concluded that a fusion power plant like the Princeton Reference Design Fusion Reactor can be constructed and operated without adverse impacts on the environment. The various parameters considered in the studies are: (1) plant site and exclusion area, (2) mining operations, (3) materials required for construction of the reactor and the reactor building, (4) the fuel supply, and air and water pollution. Author

N74-35164 Princeton Univ., N.J.
OPERATIONAL PROCEDURES **c03**
K. C. Sokolosky (Narragansett Elec. Co.) and J. File *In its* A Fusion Power Plant Aug. 1974 p 477-492 (For availability see N74-35146 24-25)

The startup and shutdown procedures of the Princeton Reference Design Fusion Reactor under various conditions are discussed. The initial startup procedure is described, followed by a description of operation at reduced power and the normal shutdown practices. Emergency shutdowns and methods of restoration of service after all shutdowns are explained. Emphasis is placed on those parts of the power plant, especially the nuclear island, that are unique to a fusion reactor. The conventional components such as the steam plant and electrical plant are described in more general terms. Author

N74-35165 Argonne National Lab., Ill.
MAINTENANCE, REPAIR AND OVERHAUL **c03**
T. A. Coultas *In* Princeton Univ. A Fusion Power Plant Aug. 1974 p 493-507 refs (For availability see N74-35146 24-25)

The maintenance criteria and the repair and overhaul situations that are envisioned to occur with the tokamak reactor are discussed. The design status of the reactor is not such that it is possible to write detailed instructions and maintenance manuals for each, or even any, component of the plant. Instead, some of the maintenance problems are indicated and how maintainability has been designed into the reactor. Some of the more obvious maintenance associated with conventional systems are related as well as some of the procedures to be used to assure adequate reliability of the plant and determine possible maintenance difficulties. The maintenance goals of this preliminary design are to develop the maintainability criteria, identify the foreseeable significant maintenance actions, tools and facilities that must be included in the design. This predominantly base-load plant has as its design goal a 200,000 hour life and an availability factor of 85%. These goals will be met by quality-control techniques applied through all stages, from preliminary design to construction and operation. Other standards in preparation and which may be applicable to this reactor are referenced. Author

N74-35166 Princeton Univ., N.J.
COST ANALYSIS **c34**
J. File *In its* A Fusion Power Plant Aug. 1974 p 508-525 refs (For availability see N74-35146 24-25)

The cost estimate of the Princeton Reference Design Fusion reactor is developed. Costs are given in 1974 dollars. The format of the Atomic Energy Commission Guide for Economic Evaluation of Nuclear Reactor Plant Designs was used. Adjustments were made to fit the requirements of a fusion reactor. It was concluded that the total capital cost of the reactor and facilities would be $1,215,230. Author

N74-35167 Princeton Univ., N.J.
USES FOR THE REFERENCE DESIGN **c03**
R. G. Mills *In its* A Fusion Power Plant Aug. 1974 p 526-530 refs (For availability see N74-35146 24-25)

A study was conducted to determine possible applications and uses of the Princeton Reference Design Fusion Reactor. Seven examples of proposed use of the reactor are cited. It is stated that the basic problem in research programs related to controlled thermonuclear fusion is the lack of knowledge of the transport properties of thermonuclear plasmas. Proposed modifications to the fusion reactor to meet certain prescribed operating conditions are proposed. Author

N74-35168 Princeton Univ., N.J.
NEEDS FOR FURTHER RESEARCH
R. G. Mills *In its* A Fusion Power Plant Aug. 1974 p 531-542 refs (For availability see N74-35146 24-25)

A study was conducted to determine the nature of additional research work required for the development of fusion reactors. Specific areas where more information is required are: (1) plasma confinement, (2) ignition, (3) fuel injection, (4) divertor design, (5) useful wall lifetimes, and (6) large toroidal confinement systems. The advantages and benefits to be realized by the application of fusion reactors for power conversion are examined. Author

N74-35169# Princeton Univ., N.J. Plasma Physics Lab.
INFINITE WAVELENGTH KINK INSTABILITIES IN UNIFORM CURRENT CYLINDRICAL PLASMAS WITH RECTANGULAR CROSS SECTIONS
M. D. Rosen Aug. 1974 18 p refs
(Contract AT(11-1)-3073)
(MATT-1063) Avail: NTIS HC $4.00

The magnetohydrodynamic stability of a plasma column with an elongated rectangular cross section, carrying a uniform axial current, was investigated. Axisymmetric modes (n = 0), for which the circular cross section case is marginally stable (m = 1) are considered. It was found that a vertical displacement with an additional perturbation, localized near the plasma surface, leads to instability. Author

N74-35170# Princeton Univ., N.J. Plasma Physics Lab.
RESISTIVE INSTABILITIES IN GENERAL TOROIDAL PLASMA CONFIGURATIONS
Alan H. Glasser, John M. Greene, and John L. Johnson Aug. 1974 63 p refs
(Contract AT(11-1)-3073; Grant NSF G-579)
(MATT-1068) Avail: NTIS HC $6.25

Work on resistive instabilities is extended to finite-pressure configurations. It is shown that the stability properties can be specified in terms of the parameters. The Mercier criterion for the stability of the ideal magnetohydrodynamic interchange mode is rederived. Author

N74-35171# Princeton Univ., N.J. Plasma Physics Lab.
ENHANCED INDUCED EMISSION FOR STIMULATED RAMAN SCATTERING IN PLASMAS
Gerhard Auer and Carl Oberman Sep. 1974 8 p refs
(Contracts AT(11-1)-3073; F44620-70-C-0033)
(MATT-1073) Avail: NTIS HC $4.00

Calculations of the iduced emission of high-frequency waves in a plasma, exposed to a pump field, are discussed. It is shown that longitudinal bremsstrahlung can be included in the calculations of these waves. Author

N74-35172# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OBSERVATIONS ON THE EFFECT OF STEPWISE IONIZATION ON THE DISTRIBUTION FUNCTION AND TRANSPORT AND BALANCING MAXIMA OF ELECTRONS IN A NEON LOW-PRESSURE PLASMA AT A LOW DEGREE OF IONIZATION
J. Wilhelm, R. Winkler, and H. Freitag 14 Jun. 1974 22 p refs Transl. into ENGLISH from Beitr. Plasmaphys. (East Ger.), v. 10, no. 2, 1970 p 171-181
(AD-782555; FTD-HC-23-1447-74) Avail: NTIS CSCL 20/9

The electron energy distribution function was calculated in a Lorentz approximation by the Boltzmann equation, and the concentration ratios of excited to nonexcited neutral atoms were determined. Correction factors were found, which amount to 10%

of the values for the transport maxima, and up to 50% for the direct excitation frequencies. Author

N74-35173# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INJECTION OF INTENSIVE FLOWS OF HIGH-SPEED HYDROGEN IONS AND ATOMS
N. N. Semashko 25 Jun. 1974 19 p refs Transl. into ENGLISH from the book "Plazmennye Uskoriteli" USSR, 1973 p 301-309
(FTD Proj. T74-04-03)
(AD-782081; FTD-HT-23-1098-74) Avail: NTIS CSCL 20/9

The report discusses ion injectors, including ion sources, focusing, and neutralization. Hydrogen ion beams are discussed as examples. GRA

N74-35174# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Electrical Engineering.
BEHAVIOR OF PLASMOID INJECTED INTO A RISING MAGNETIC FIELD FOR INITIATING FUSION REACTIONS Final Report, 1 Feb. 1969 - 31 Jan. 1974
John G. Siambis May 1974 130 p refs
(Grant AF-AFOSR-1708-69; AF Proj. 9752)
(AD-783289; AFOSR-74-1225TR) Avail: NTIS CSCL 20/9

The report reviews the research program supported by the contract. Four broad areas were investigated as follows: the supersonic-subsonic flow transition and shock formation of a dense plasma stream injected longitudinally along a variable magnetic field, the multiple resonance excitation of a plasma column at the high frequency and low frequency resonances and the related ion temperature enhancement in the presence of a collisional thermalization mechanism; the computer simulation and modeling of the electrical breakdown of a gas, avalance and streamer formation and propagation including gas photoionization; and, the study of Drift Waves in toroidal geometry with various types of shear, and with trapped particles due to the variation of magnetic field along the field lines. (Modified author abstract) GRA

N74-35175# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ACCELERATORS WITH A CLOSED HALL CURRENT
S. D. Grishin and V. S. Erofeev 25 Jun. 1974 17 p refs Transl. into ENGLISH from the monograph "Plazmennye Uskoriteli" USSR, 1973 p 54-61
(AD-782537; FTD-HT-23-1047-74) Avail: NTIS CSCL 20/9

A sharp decrease in the transverse mobility of the electron component of a plasma in a strong magnetic field was achieved by using a plasma magnetohydrodynamic accelerator with a closed Hall current, which produces considerable strength in the electrical field with extremely low electron current densities perpendicular to the magnetic field. The pattern of motion of ions and electrons in the accelerator, the electron ionization processes in the residual gas, and the possible drift of electrons towards the walls of the accelerating chamber, are discussed mathematically. The theoretical and experimental studies which confirm the physical premises of accelerators with closed Hall currents, and which enable the construction of devices which form intensive stationary flows of accelerated plasma are discussed. A.A.D.

N74-35176# California Inst. of Tech., Pasadena. Antenna Lab.
ELECTROMAGNETIC PULSES AT THE BOUNDARY OF A NONLINEAR PLASMA Technical Interim Report
Edgar H. Satorius Aug. 1974 117 p refs
(Grant AF-AFOSR-1935-70; AF Proj. 9768)
(AD-783266; TR-71) Avail: NTIS CSCL 20/9

The paper describes an investigation of the behavior of strong electromagnetic pulses at the boundary of a nonlinear, cold, collisionless, and uniform plasma. The nonlinearity considered here is due to the nonlinear terms in the fluid equation which is used to describe the plasma. Two cases are studied; first considered is the case where there is a voltage pulse applied across the plane boundary of a semi-infinite, nonlinear plasma. In the second case, the reflection of incident E-polarized and H-polarized, electromagnetic pulses at various angles of incidence from a nonlinear, semi-infinite plasma is considered. (Modified author abstract) GRA

N74-35177# Naval Postgraduate School, Monterey, Calif.
BREAKDOWN PHENOMENA IN RARE AND IN MOLECULAR GASES USING PULSED CARBON DIOXIDE LASER RADIATION M.S. Thesis
Peter Behrens Jun. 1974 91 p refs
(AD-783855) Avail: NTIS CSCL 20/9

Light from an atmospheric pressure, double-discharge CO2 laser was focused in Ar, He, N2, H2, and air at pressures from 0.01 atm to 10 atm in order to produce optical breakdown. Measurements of the transmitted laser intensity were obtained and the properties of the resulting spark were studied by means of an open face camera and spectroscopic techniques. The threshold power density was discussed. The importance of loss terms other than electron diffusion loss was discussed. Emission spectra consisted of a strong continuum superimposed with strong lines due to neutral and ionized atoms. (Modified author abstract) GRA

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N74-35178 California Inst. of Tech., Pasadena.
AN EXPERIMENTAL STUDY OF NONEQUILIBRIUM SUPERCONDUCTIVITY Ph.D. Thesis
Ming Lun Yu 1974 162 p
Avail: Univ. Microfilms Order No. 74-17959

The transport properties of several superconducting systems, in which the superconducting state was out of thermodynamic equilibrium, were investigated by creating a steady state depairing region at a supernormal interface with a transport current. Information was obtained by direct probing of the potential profiles in the depairing region. Measurements were made with superconducting microcircuits with high spatial resolution extending to the scale of the wavelength of light. It was found that, at the depairing region, the experimental results can be described by the existence of two distinct potentials, one for the single electron excitations, and one for the electron pairs. A theory for the dynamics of the nonequilibrium process was proposed and succeeded in accounting for most of the experimental observations. Dissert. Abstr.

N74-35179 Turku Univ. (Finland). Wihuri Physical Lab.
MEAN-SQUARE ATOMIC VIBRATION AMPLITUDES OF BODY-CENTERED CUBIC METALS AT LOW TEMPERATURES
V. Hovi and M. Komu 1974 12 p refs
(Rept-412) Copyright. Avail: Issuing Activity

The mean-square displacements of volume atoms at low temperatures in body-centered cubic metals K, V, Nb, Ta, Cr, Mo, W, and alpha-Fe were determined. The calculated values of the mean square displacements are in satisfactory agreement with those obtained from the theoretical and experimental X-ray Debye temperatures and Debye-Waller coefficients. The results indicate that the convergence of the expansion of the dynamical matrix is sufficient as the temperature approaches 0 K. The Gruneisen relationship between the mean-square atomic vibration amplitudes and the thermal expansion for cubic solids was also investigated in the case of alpha-Fe. Author

N74-35180 Connecticut Univ., Storrs.
LOW TEMPERATURE EPITAXIALLY-GROWN Ge-GaAs AND Ge-ZnSe HETEROJUNCTIONS Ph.D. Thesis
Faquir Chand Jain 1973 121 p
Avail: Univ. Microfilms Order No. 74-21817

Shiny, mirror-smooth epitaxial layers of Ge were grown on Ge, GaAs, and ZnSe substrates using GeI2 disproportionation reaction in the temperature range of 330 to 420 C. The high quality layers are grown on (100), (110), (111), (111-4 deg-100), and (211) oriented substrates using Ge-I2-He, Ge-I2-H2, and Ge-I2-He-H2 systems. Growth rates up to 10 microns/hour were obtained. The influence of growth parameters such as flow rates, iodine source pressure and seed temperature growth rates, and surface morphology of the grown layers were investigated. A

correlation between surface morphology and carrier mobilities, at a given carrier concentration, is discussed. Carrier mobilities in shiny, structureless surfaces are always found to be higher than that of partially-smooth or structural layers. Influence of arsenic and boron doping levels on growth rates and surface morphology of the grown layers is discussed. Dissert. Abstr.

N74-35181*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PHONONS IN QUANTUM SOLIDS WITH DEFECTS
N. Jacobi and J. S. Zmuidzinas 1 Sep. 1974 47 p refs
(Contract NAS7-100)
(NASA-CR-140178; JPL-TM-33-701) Avail: NTIS HC $5.50 CSCL 20L

A formalism was developed for temperature-dependent, self-consistent phonons in quantum solids with defects. Lattice vacancies and interstitials in solid helium and metallic hydrogen, as well as electronic excitations in solid helium, were treated as defects that modify properties of these systems. The information to be gained from the modified phonon spectrum is discussed. Author

N74-35182*# Honeywell, Inc., Lexington, Mass. Radiation Center.
STUDY TO IMPROVE THE LOW FREQUENCY NOISE CHARACTERISTICS OF (Hg,Cd)Te DETECTORS Final Report, 16 Apr. 1971 - 31 Aug. 1973
Robert M. Broudy [1973] 53 p refs
(Contract NAS1-10682)
(NASA-CR-132512) Avail: NTIS HC $3.75 CSCL 20L

Efforts made to identify and reduce the sources of I/f noise in 15 micron n-type (Hg,Cd)Te detectors operating at 77 K are reported. The investigation covered: evaluation of the influence of material properties and detector processing techniques, determination of the relative importance of surfaces, volumes, regions, and contracts, and generation of theoretical models for guidance of the experimental work. Author

N74-35183*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN ELECTROCHEMICAL STUDY OF A LIQUID CRYSTAL USED IN INFORMATION DISPLAYS Interim Report
Donald M. Oglesby (Old Dominion Univ.), JoAnn B. Kern (Old Dominion Univ.), and James B. Robertson Oct. 1974 28 p refs
(NASA-TM-X-72620) Avail: NTIS HC $3.25 CSCL 20B

The operational lifetime of liquid crystal displays were investigated. Electrochemical reaction at the electrodes of the display can cause failure after 2000 to 3000 hours of operation. Studies using cyclic voltametry of electrochemical reactions of N (p-methoxybenzilidene p-butylaniline (MBBA), a nematic liquid crystal were made. These studies indicate the presence of a reversible reduction of MBBA at the cathode, and that the reduction product undergoes a further reaction leading to products which are not reversibly oxidized. It is concluded that the degradation of the liquid crystal in displays can be reduced with a suitable frequency of alternating voltage. Author

N74-35184*# Texas A&M Univ., College Station. Inst. for Solid-State Electronics.
GRAVITATIONAL EFFECTS OF PROCESS-INDUCED DISLOCATIONS IN SILICON Final Report
W. A. Porter and Donald L. Parker 20 Sep. 1974 27 p
(Contract NAS8-29851; Proj. 1031)
(NASA-CR-120477) Avail: NTIS HC $4.50 CSCL 20L

Matters pertaining to semiconductor device fabrication were studied in terms of the influence of gravity on the production of dislocations in silicon wafers during thermal cycling in a controlled ambient where no impurities are present and oxidation is minimal. Both n-type and p-type silicon wafers having a diameter of 1.25 in to 1.5 in, with fixed orientation and resistivity values, were used. The surface dislocation densities were measured quantitatively by the Sirtl etch technique. The results show two significant features of the plastic flow phenomenon as it is related to gravitational stress: (1) the density of dislocations generated during a given thermal cycle is directly related to the duration of the cycle; and (2) the duration of the thermal cycle required to produce a given dislocation density is inversely related to the equilibrium temperature. Analysis of the results indicates that gravitational stress is instrumental in process-induced defect generation. A.A.D.

N74-35185# Maryland Univ., College Park. Center for Theoretical Physics.
EXPERIMENTAL TEST FOR THE CHARGE SUPERSELECTION RULE
D. Kershaw and C. H. Woo Sep. 1974 11 p refs
(Grant NSF GP-32418)
(TR-75-020) Avail: NTIS HC $4.00

An experiment is suggested to test the existence of a phase correlation for two space-separated superconductors. The phase in question is that of the eigenvalue of the operator S that creates a pair in one superconductor and removes a pair from the other. This will also provide a clear cut test for the charge and lepton number superselection rules. Author

N74-35186# Rochester Univ., N.Y. Dept. of Electrical Engineering.
ELASTIC SURFACE WAVES IN THE PRESENCE OF A FLUID LAYER Final Report, 1 Apr. 1972 - 30 Sep. 1973
P. Das May 1974 291 p refs
(Contract F30602-72-C-0312; AF Proj. 5573)
(AD-782419; RADC-TR-74-125) Avail: NTIS CSCL 20/12

This is a comprehensive report on the theoretical and experimental performance of devices using elastic surface waves in layered structures. The following are the main achievements of this effort: (1) Space charge coupled convolvers and correlators using surface wave and layer wave; experimental demonstration of lowest insertion loss, a few orders of magnitude lower than the previous state-of-the-art devices and development of a detailed theory. (2) A new technique for optical probing of surface waves and layer waves: experimental determination of the decay parameter of a surface wave in the direction normal to the propagation surface and the complete elastic fields in the layer wave structure, demonstration of 25% diffraction efficiency for each first order with only 500 mw of electrical power driving the surface wave transducers. Other important contributions in this report are the theoretical analysis of the layer wave propagation including loss or gain, and the observation of streaming phenomena in a liquid layer due to layer waves.
Author (GRA)

N74-35187# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
SCATTERING OF A RAYLEIGH WAVE BY THE EDGE OF A THIN SURFACE LAYER
Donald A. Simons Jul. 1974 77 p refs
(Contract N00014-67-A-0094-0020; NR Proj. 064-031)
(AD-782610; TR-30) Avail: NTIS CSCL 20/12

The investigation treats the problem of the scattering of a Rayleigh wave by the edge of a thin layer which covers half the surface of an elastic half-space. The interaction between the layer and the half-space is described approximately by means of a model in which the effect of the layer is represented by a pair of boundary conditions at the surface of the half-space. Two parameters - one representing mass and the other, stiffness - are found to characterize the layer. The incident Rayleigh wave impinges normally upon the plated region from the unplated side. (Modified author abstract) GRA

N74-35188# Cambridge Univ. (England). Cavendish Lab.
ON CHARGE ORDERING IN Fe_3O_4
P. Fazekas 1974 19 p refs
(Grant AF-AFOSR-2449-73; AF Proj. 9761)
(AD-782318; TCM/62/1973; AFOSR-74-1035TR) Avail: NTIS CSCL 20/12

The degree of short range order in the ground state of the usual nearest neighbor interaction model for magnetite is examined with a variational procedure. It is found that the short range order will become reasonably complete only for rather large interaction strengths. Consequences for the probable causes of the metal-non metal transition are briefly discussed.
Author (GRA)

N74-35189# Ballistic Research Labs., Aberdeen Proving Ground, Md.
LIGHT INDUCED MODULATION OF ABSORPTION (LIMA)

IN COPPER-DOPED SINGLE CRYSTALS CdS PLATELETS. PART 1: EXPERIMENTAL Final Report
William F. Braerman Jun. 1974 57 p refs
(DA Proj. 1T1-61101-A-91A)
(AD-782964; BRL-1721) Avail: NTIS CSCL 20/12

The study concerns experimental observations of induced modulated transmittance of a weak monochromatic light probe due to chopped laser excitation. The author varied the weak light probe wavelength, crystal temperature, laser excitation chopping frequency, and intensity. Also provided are luminescence and photoconductivity measurements; these are compared with the Light Induced Modulation of Absorption (LIMA) measurements. Results indicate that substantial changes in modulated transmittance occur. It is thought that the technique based on LIMA may well lead to a better understanding of trapping and recombination kinetics in semiconductors. GRA

N74-35190# Cornell Univ., Ithaca, N.Y. Materials Science Center.
DIRECT MEASUREMENT OF CURRENT-PHASE RELATIONS IN SUPERCONDUCTING WEAK LINKS
L. D. Jackel, R. A. Buhrman, and W. W. Webb 15 Jul. 1974 18 p refs
(Contract N00014-67-A-0077-0016; NR Proj. 319-032)
(AD-782719; MSC-2260; TR-19) Avail: NTIS CSCL 20/12

A method for the direct measurement of the current-phase i(theta) relations in superconducting weak links is reported. It is shown that by proper choice of experimental parameters, an accurate measurement of i(theta) can be obtained in spite of obscuring effects of thermal fluctuations. This method has been used to obtain the current-phase relation of an oxidized niobium point contact and has shown that it conforms closely to the sinusoidal Josephson relation. (Modified author abstract) GRA

N74-35191# Rockwell International Corp., Anaheim, Calif. Electronics Research Div.
EFFECTS OF NUCLEAR RADIATION ON MAGNETIC BUBBLE DOMAIN MATERIALS AND DEVICES
R. A. Williams Oct. 1973 45 p
(Contract F19628-73-C-0250; AF Proj. 6096)
(AD-782015; C73-1102/501; AFCRL-TR-73-0712; SR-1) Avail: NTIS CSCL 09/2

The work described in this report is an extension of work performed on Contract no. F19628-72-C-0342. The present effort is primarily concerned with establishing failure thresholds and mechanisms of magnetic bubble domain devices. Four types of experiments were performed. A study was made of the effect of 60 KV X-rays on the hard bubble suppression properties of a neon implanted layer in (YSm)3(FeGa)5O12 material. Radiation burn-out of 300 A permalloy domain sensors was found to occur with 30 ns pulses of 1.5 MeV electrons at doses above 30,000 rads/pulse. The stability of stored information in a transient ionizing environment was investigated. Finally, measurements were made of the transient radiation response of domain sensors. (Modified author abstract) GRA

N74-35192# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
[ELECTRONICS RESEARCH PROGRAMS] Consolidated Semiannual Progress Report, 1 Apr. - 1 Oct. 1973
1 Oct. 1973 91 p
(Contract F44620-71-C-0067; AF Proj. 4751; AF Proj. 6813)
(AD-783332; AFOSR-74-1255TR; SAPR-18) Avail: NTIS CSCL 20/12

This report presents a summary of the research program in the broad field of electronics conducted during the past six months by the Electronic Sciences Laboratory, University of Southern California. The program includes research in solid state materials, semiconductors and devices, quantum electronics, plasmas, applied electromagnetics, electrical engineering systems to include control, communication, computer and power systems, biomedical engineering and mathematical biosciences. (Modified author abstract) GRA

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N74-35193 Pennsylvania State Univ., University Park.
BURNING RATE RESPONSE OF LIQUID MONOPROPELLANTS TO IMPOSED PRESSURE OSCILLATION Ph.D. Thesis
Carl Bruce Allison 1974 150 p
Avail: Univ. Microfilms Order No. 74-20983

The combustion characteristics of hydrazine strands were studied under both steady state and oscillatory conditions. A steady strand burner was used to measure steady strand burning rates, liquid temperature distributions and surface temperatures as a function of pressure in the pressure range of 0.32 to 42 atm. It was found that for subatmospheric pressures the burning rate varied as the square root of pressure; for pressures greater than atmospheric the burning rate varied linearly with pressure. A theoretical model of the strand combustion system was developed and matched to the steady burning rates by assuming a reaction order of one for subatmospheric pressures and a reaction order of two for pressures greater than atmospheric. The model was also found to be in good agreement with measurements of liquid temperature distributions and surface temperatures. With the confidence gained in the model from the steady results, predictions were made of oscillatory burning rates.
Dissert. Abstr.

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N74-35194*# Tennessee Univ. Space Inst., Tullahoma.
ON THE INLET VORTEX SYSTEM Final Report
Norbert C. Bissinger and Gerhard W. Braun Sep. 1974 104 p refs
(Grant NGR-43-001-086; NASA-CR-140182) Avail: NTIS HC $8.25 CSCL 21E

The flow field of a jet engine with an inlet vortex, which can pick up heavy debris from the ground and damage the engine, was simulated in a small water tunnel by means of the hydrogen bubble technique. It was found that the known engine inlet vortex is accompained by a vortex system, consisting of two inlet vortices (the ground based and the trailing one), secondary vortices, and ground vortices. Simulation of the ground effect by an inlet image proved that the inlet vortex feeds on free stream vorticity and can exist without the presence of a ground boundary layer. The structural form of the inlet vortex system was explained by a simple potential flow model, which showed the number, location, and the importance of the stagnation points. A retractable horizontal screen or an up-tilt of the engine is suggested as countermeasure against debris ingestion. Author

N74-35195*# Pratt and Whitney Aircraft, West Palm Beach, Fla. Research and Development Center.
DESIGN STUDY OF RL10 DERIVATIVES. VOLUME 2: ENGINE DESIGN CHARACTERISTICS Final Report
A. Adams 15 Dec. 1973 459 p refs
(Contract NAS8-28989)
(NASA-CR-120145; FR-6011-Vol-2) Avail: NTIS HC $26.00 CSCL 21H

The design characteristics of the RL-10 rocket engine are discussed. The results from critical elements evaluation, baseline engine design, parametric and special study tasks are presented. Critical element evaluation established the feasibility of various engine features such as tank head idle, pumped idle, autogenous

tank pressurization, and two-phase pumping. Three baseline engines, derived from the RL-10 were conceptually designed. Parametric life and performance data were generated. Special studies were conducted to establish the impact on the engine design of environment, safety, interchangeability, and maintenance. Author

N74-35196*# Pratt and Whitney Aircraft, West Palm Beach, Fla. Research and Development Center.
DESIGN STUDY OF RL10 DERIVATIVES. VOLUME 2: ENGINE DESIGN CHARACTERISTICS, APPENDICES Final Report
15 Dec. 1973 205 p refs
(Contract NAS8-28989)
(NASA-CR-120144; FR-6011-Vol-2-App) Avail: NTIS HC $13.25 CSCL 21H

Calculations, curves, and substantiating data which support the engine design characteristics of the RL-10 engines are presented. A description of the RL-10 ignition system is provided. The performance calculations of the RL-10 derivative engines and the performance results obtained are reported. The computer simulations used to establish the control system requirements and to define the engine transient characteristics are included. Author

N74-35197*# Pratt and Whitney Aircraft, West Palm Beach, Fla. Research and Development Center.
DESIGN STUDY OF RL10 DERIVATIVES. VOLUME 3, PART 1: PRELIMINARY INTERFACE CONTROL DOCUMENT Final Report
A. Adams 15 Dec. 1973 146 p
(Contract NAS8-28989)
(NASA-CR-120146; FR-6011-Vol-3-Pt-1) Avail: NTIS HC $10.50 CSCL 21H

The Interface Control Document contains engine information necessary for installation of the baseline RL10 Derivative engines in the Space Tug vehicle. The ICD presents a description of the baseline engines and their operating characteristics, mass and load characteristics, and environmental criteria. The document defines the engine/vehicle mechanical, electrical, fluid and pneumatic interface requirements. Author

N74-35198*# Pratt and Whitney Aircraft, West Palm Beach, Fla. Research and Development Center.
DESIGN STUDY OF RL10 DERIVATIVES. VOLUME 3, PART 2: OPERATIONAL AND FLIGHT SUPPORT PLAN Final Report
W. C. Shubert 15 Dec. 1973 122 p
(Contract NAS8-28989)
(NASA-CR-120148; FR-6011-Vol-3-Pt-2) Avail: NTIS HC $9.25 CSCL 21H

Transportation requirements are considered during the engine design layout reviews and maintenance engineering analyses. Where designs cannot be influenced to avoid transportation problems, the transportation representative is advised of the problems permitting remedies early in the program. The transportation representative will monitor and be involved in the shipment of development engine and GSE hardware between FRDC and vehicle manufacturing plant and thereby will be provided an early evaluation of the transportation plans, methods and procedures to be used in the space tug support program. Unanticipated problems discovered in the shipment of development hardware will be known early enough to permit changes in packaging designs and transportation plans before the start of production hardware and engine shipments. All conventional transport media can be used for the movement of space tug engines. However, truck transport is recommended for ready availability, variety of routes, short transit time, and low cost. Author

N74-35199*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Space Systems Div.
SOLAR ARRAY TECHNOLOGY EVALUATION PROGRAM FOR SEPS (SOLAR ELECTRICAL PROPULSION STAGE) Final Report
1 Sep. 1974 253 p refs
(Contract NAS8-30315)
(NASA-CR-120483; LMSC-D384250) Avail: NTIS HC $15.75 CSCL 21C

An evaluation of the technology and the development of a preliminary design for a 25 kilowatt solar array system for solar electric propulsion are discussed. The solar array has a power to weight ratio of 65 watts per kilogram. The solar array system is composed of two wings. Each wing consists of a solar array blanket, a blanket launch storage container, an extension/retraction mast assembly, a blanket tensioning system, an array electrical harness, and hardware for supporting the system for launch and in the operating position. The technology evaluation was performed to assess the applicable solar array state-of-the-art and to define supporting research necessary to achieve technology readiness for meeting the solar electric propulsion system solar array design requirements. Author

N74-35200*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EIGHT-cm MERCURY ION THRUSTER SYSTEM TECHNOLOGY
1974 121 p refs Presented at AIAA/SAE 10th Propulsion Conf., San Diego, Calif., 21-23 Oct. 1974
(NASA-TM-X-71611; AIAA-74-1116) Avail: NTIS HC $4.50 CSCL 21C

The technology status of 8 cm diameter electron bombardment ion thrusters is presented. Much of the technology resulting from the 5 cm diameter thruster has been adapted and improved upon to increase the reliability, durability, and efficiency of the 8 cm thruster. Technology discussed includes: dependence of neutralizer tip erosion upon neutralizer flow rate; impregnated and rolled-foil insert cathode performance and life testing; neutralizer position studies; thruster ion beam profile measurements; high voltage pulse ignition; high utilization ion machined accelerator grids; deposition internal and external to the thruster; thruster vectoring systems; thruster cycling life testing and thruster system weights for typical mission applications. Author

N74-35201*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF INLET INGESTION OF A WING TIP VORTEX ON TURBOJET STALL MARGIN
Glenn A. Mitchell Sep. 1974 57 p refs
(NASA-TM-X-71610; E-8091) Avail: NTIS HC $3.75 CSCL 21E

A two-dimensional inlet and a turbojet engine were investigated in a Mach 0.4 stream so as to ingest the tip vortex of a forward mounted wing. Results show that ingestion of a wing tip vortex by a turbojet engine can cause a large reduction in engine stall margin. The loss in stall compressor pressure ratio was primarily dependent on vortex location and rotational direction and not on total-pressure variations across the compressor face. Author

N74-35202*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF A MODEL CASCADE THRUST REVERSER FOR SHORT-HAUL APPLICATIONS
Donald A. Dietrich and Orlando A. Gutierrez 1974 41 p refs Presented at the 10th Propulsion Conf., San Diego, Calif., 21-23 Oct. 1974; sponsored by AIAA and SAE
(NASA-TM-X-71614; E-8119) Avail: NTIS HC $3.25 CSCL 21E

Aerodynamic and acoustic characteristics are presented for a cowlmounted, model cascade thrust reverser suitable for short-haul aircraft. Thrust reverser efficiency and the influence on fan performance were determined from isolated fan-driven models under static and forward velocity conditions. Cascade reverser noise characteristics were determined statically in an isolated pipe-flow test, while aerodynamic installation effects were determined with a wind-tunnel, fan-powered airplane model. Application of test results to short-haul aircraft calculations demonstrated that such a cascade thrust reverser may be able to meet both the performance and noise requirements for short-haul aircraft operation. However, aircraft installation effects can be quite significant. Author

N74-35203*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COLD-FLOW PERFORMANCE OF SEVERAL VARIATIONS

OF A RAM-AIR-COOLED PLUG NOZZLE FOR SUPERSONIC-CRUISE AIRCRAFT
Douglas E. Harrington, Stanley M. Nosek, and David M. Straight
Washington Oct. 1974 37 p refs
(NASA-TM-X-3110; E-7975) Avail: NTIS HC $3.25 CSCL 20D

Experimental data were obtained with a 21.59 cm (8.5 in.) diameter cold-flow model in a static altitude facility to determine the thrust and pumping characteristics of several variations of a ram-air-cooled plug nozzle. Tests were conducted over a range of nozzle pressure ratios simulating supersonic cruise and takeoff conditions. Primary throat area was also varied to simulate afterburner on and off. Effect of plug size, outer shroud length, primary nozzle geometry, and varying amounts of secondary flow were investigated. At a supersonic cruise pressure ratio of 27, nozzle efficiencies were 99.7 percent for the best configurations. Author

N74-35204*# Rocketdyne, Canoga Park, Calif.
A STUDY OF THE DURABILITY OF BERYLLIUM ROCKET ENGINES Final Report
R. D. Paster and G. C. French Oct. 1974 217 p ref
(Contract NAS9-13476)
(NASA-CR-140308; R-9557) Avail: NTIS HC $14.00 CSCL 21H

An experimental test program was performed to demonstrate the durability of a beryllium INTEREGEN rocket engine when operating under conditions simulating the space shuttle reaction control system. A vibration simulator was exposed to the equivalent of 100 missions of X, Y, and Z axes random vibration to demonstrate the integrity of the recently developed injector-to-chamber braze joint. An off-limits engine was hot fired under extreme conditions of mixture ratio, chamber pressure, and orifice plugging. A durability engine was exposed to six environmental cycles interspersed with hot-fire tests without intermediate cleaning, service, or maintenance. Results from this program indicate the ability of the beryllium INTEREGEN engine concept to meet the operational requirements of the space shuttle reaction control system. Author

N74-35205*# Rocketdyne, Canoga Park, Calif.
A STUDY OF THE DURABILITY OF BERYLLIUM ROCKET ENGINES Executive Summary
R. D. Paster and G. C. French Oct. 1974 46 p
(Contract NAS9-13476)
(NASA-CR-140309; R-9557-1) Avail: NTIS HC $5.50 CSCL 21H

For abstract, see N74-35204.

N74-35206# Aerospace Corp., El Segundo, Calif. Lab. Operations.
EXPERIMENTAL EVALUATION OF COATED GRAPHITE ICBM ROCKET NOZZLE THROAT INSERTS Interim Report
Jay G. Baetz 12 Jun. 1974 73 p refs
(Contract F04701-74-C-0075)
(AD-783200; TR-0075(5546)-1; SAMSO-TR-74-158) Avail: NTIS CSCL 21/8

An experimental procedure for determining the net residual stress of a typical ICBM coated nozzle throat insert is described. The experiment includes provisions for separating substrate-induced stresses from the primary and secondary coating stresses. The results of such experiments conducted on a pure pyrolytic graphite coated insert and on a codeposited silicon carbide and pyrolytic graphite insert are discussed. (Modified author abstract) GRA

N74-35207# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ROCKET ENGINES ON A COMBINED FUEL
E. B. Volkov and G. Yu. Mazing 24 Jun. 1974 256 p refs
Transl. into ENGLISH of the monograph "Raketnye Dvigateli na Kombinirovannom Toplive" Moscow, 1973 p 1-184
(AD-783752; FTD-MT-24-827-74) Avail: NTIS CSCL 21/8

Contents: General information about combined rocket engines; Heat exchange in the combustion chamber of combined rocket engines; Heterogeneous burning in the combined rocket engine; Selection of the basic parameters of combustion chamber of a combined rocket engine; Static characteristics of combined rocket engines; The control of combined rocket engines. GRA

N74-35208# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDY OF LOCAL HEAT EXCHANGE ALONG THE CONTOUR OF A TURBINE PROFILE
V. M. Kapinos and A. F. Slitenko 25 Jun. 1974 13 p refs
Transl. into ENGLISH from Energ. Mashinostr. (USSR), no. 10, 1970 p 42-47
(AD-783560; FTD-HT-23-914-74) Avail: NTIS CSCL 21/5

The distribution of local coefficients of heat transfer from a gas to a turbine blade along the profile is discussed. The heat transfer coefficients were determined by using the value of the mean heat transfer coefficients characterizing the heat exchange on the profile sections whose length corresponded to the width of the lines of electrical heaters located on the generatrices of the profile. The parameters determined by the test were: (1) air flow rate through the cascade, (2) pressure ahead of and beyond the cascade, (3) current intensity in the circuit of the electrical heater, (4) total voltage drop in the electric heater, and (5) the temperature of the middle strip at 21 points. A diagram of profile of the studied blade and the position of the thermocouples is provided. Graphs of the heat transfer coefficients are included. Author

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear.

N74-35209 Rice Univ., Houston, Tex.
UNUSUAL SOLAR WIND AND SOLAR PROTON EVENTS OBSERVED ON THE LUNAR SURFACE Ph.D. Thesis
Rene Adalid Medrano-Balboa 1974 199 p
Avail: Univ. Microfilms Order No. 74-21308

Observations of interplanetary ions made by the Rice University suprathermal Ion Detector Experiments (SIDEs) which form part of the Apollo Lunar Surface Experiment Packages (ALSEPs), are reported. None of the detectors of the SIDEs look directly into the solar wind. Therefore the instruments can only detect deviated solar wind ions or cosmic rays that are able to penetrate the shielding of the detectors. Two events of these types have been detected by the experiments. The first event (November 19, 1970) was observed by the Apollo 12 ALSEP-SIDE and consisted of the detection of ions from 26.3 deg off the normal wind direction. The data of this event were least squares fitted using an analytical approximation named Parabolic Hypersurface Approximation. The results of the fit combined with two other experiments show that the disturbance was due to the passage of a tangential discontinuity whose characteristics fit surprisingly well with theoretical prediction. Dissert. Abstr.

N74-35210 Rice Univ., Houston, Tex.
PRODUCTION OF HELIUM, NEON, AND ARGON IN LUNAR MATERIAL BY SOLAR COSMIC RAY PROTONS Ph.D. Thesis
James Richmond Walton 1974 316 p
Avail: Univ. Microfilms Order No. 74-21347

To determine He, Ne, and Ar cross sections in important target elements, twelve proton (11-45 MeV) irradiations were performed on stacks of Mg, Al, Si, Ca, CaF2, Ti, and stainless steel foils. The inert gases produced in selected Mg, Al, Si, and CaF2 foils were measured mass spectrometrically. Using the Na22 activities measured in the Mg foils as the proton monitor, the following cross sections were determined: (1) He3, He4, Ne20, Ne21, and Ne22 in Mg, Al, and Si; (2) Na22 in Al and Si, and (3) He3, He4, Ar36, Ar37, Ar38, Ar39, Ar40, and Ar42 in CaF2. Based on these cross sections and/or others in literature, excitation functions were constructed up to 45 and 200 MeV. With these functions, the following solar cosmic ray (SCR)-proton production rates were computed as a function of depth for isotropic incidence of two SCR-proton spectra. Dissert. Abstr.

N74-35211 Colorado Univ., Boulder.
A SPECTROSCOPIC STUDY OF DYNAMIC PHENOMENA IN SUNSPOTS Ph.D. Thesis
Rodney Brian Schultz 1974 270 p
Avail: Univ. Microfilms Order No. 74-22388

Some recently discovered dynamic phenomena in sunspots are studied with a view toward understanding the physical processes responsible for these events and the mechanical energy transport mechanisms important in the overall energy balance of sunspots. Spectrograph observations with high spatial and temporal resolution were made in a number of sunspots. Fraunhofer lines of various strengths were used in order to probe the sunspot atmosphere at various heights. These observations place restrictions on the modes of mechanical energy transport that can couple the umbral flashes to the subphotospheric oscillations that have been proposed as possible energy sources for the flashes. In addition, the mechanical energy fluxes associated with the periodic phenomena currently observed in sunspots are found to be insignificant compared to the radiative energy deficit of sunspots. Dissert. Abstr.

N74-35212 Colorado Univ., Boulder.
THREE-DIMENSIONAL SOLAR WIND MODELING Ph.D. Thesis
Steven Francis Nerney 1974 226 p
Avail: Univ. Microfilms Order No. 74-22378

A steady, axisymmetric, nondissipative, three-dimensional solar wind model is investigated through the use of a perturbation expansion in inverse Rossby numbers (the ratio of the Coriolis force to the inertial term). Numerical results are presented for the polytropic approximation, however, the solutions far from the sun are independent of this approximation. The meridional magnetic pressure gradient causes mass to be transported away from the equator creating an apparent sink in the two-dimensional continuity equation there. The mass loss in the equatorial plane is estimated to be a 10 to 20 percent effect at 5 AU growing logarithmically to considerably larger values at greater distances. This secular growth is so slow that the linearization is probably valid out to the heliosphere. Energy is also channeled from Maxwell stresses into the radial velocity in the equatorial plane. Over the poles, the radial velocity is decreased from spherically symmetric values with an increase in magnetic flux there. Dissert. Abstr.

N74-35213 California Inst. of Tech., Pasadena.
OBSERVATIONS OF THE SOLAR-WIND TURBULENCE NEAR THE SUN Ph.D. Thesis
Philip Sidney Callahan 1974 159 p
Avail: Univ. Microfilms Order No. 74-21589

Solar wind turbulence near the sun is investigated with data obtained near the superior conjunctions of Mariners 6, 7 and 9. The data are time histories of the change in the electron columnar content between the earth and spacecraft. Data were obtained with a group-phase technique which is sensitive only to the change in the columnar content. The measurement technique is discussed and the theory of power spectra is outlined. The relationship between the temporal power spectrum of the columnar content data and the comoving wave-number spectrum of the solar wind is derived. The relationship of the present observations to theories of solar wind heating and to interplanetary scintillation observations is discussed. Dissert. Abstr.

N74-35214*# Stanford Univ., Calif. Inst. for Plasma Research.
RELATIVE CORONAL ABUNDANCES DERIVED FROM X-RAY OBSERVATIONS 3: THE EFFECT OF CASCADES ON THE RELATIVE INTENSITY OF Fe (XVII) LINE FLUXES, AND A REVISED IRON ABUNDANCE
A. B. C. Walker, Jr., H. R. Rugge (Aerospace Corp., Los Angeles), and Kay Weiss (Aerospace Corp., Los Angeles) Aug. 1974 38 p refs
(Grant NGR-05-020-695)
(NASA-CR-140513; SU-IPR-589) Avail: NTIS HC $5.00 CSCL 03B

Permitted lines in the optically thin coronal X-ray spectrum were analyzed to find the distribution of coronal material, as a function of temperature, without special assumptions concerning coronal conditions. The resonance lines of N, O, Ne, Na, Mg, Al, Si, S, and Ar which dominate the quiet coronal spectrum below 25A were observed. Coronal models were constructed and the relative abundances of these elements were determined. The intensity in the lines of the 2p-3d transitions near 15A was used in conjunction with these coronal models, with the assumption of coronal excitation, to determine the Fe XVII abundance. The relative intensities of the 2p-3d Fe XVII lines observed in the corona agreed with theoretical prediction. Using a more complete theoretical model, and higher resolution observations, a revised calculation of iron abundance relative to hydrogen of 0.000026 was made. Author

N74-35215*# California Inst. of Tech., Pasadena.
OBSERVATIONS OF HYDROGEN AND HELIUM ISOTOPES IN SOLAR COSMIC RAYS Ph.D. Thesis
Gordon James Hurford Oct. 1974 135 p refs
(Contract NAS5-11066; Grant NGR-05-002-160)
(NASA-CR-140568; SRL-74-3) Avail: NTIS HC $9.75 CSCL 03B

The isotopic composition of hydrogen and helium in solar cosmic rays provides a means of studying solar flare particle acceleration mechanisms since the enhanced relative abundance of rare isotopes, such as H-2, H-3, and He-3, is due to their production by inelastic nuclear collisions in the solar atmosphere during the flare. Electron isotope spectrometer on an IMP spacecraft was used to measure this isotopic composition. The response of the dE/dx-E particle telescope is discussed, and alpha particle channeling in thin detectors is identified as an important background source affecting measurement of low values of (He-3/He-4). The flare-averaged results obtained for the period October, 1972 November, 1973 are given. Author

N74-35216*# Stanford Univ., Calif. Inst. for Plasma Research.
A MODEL OF CORONAL HOLES
W. M. Adams and P. A. Sturrock Sep. 1974 20 p refs
(Grant NGL-05-020-272; Contract N00014-67-A-0112-0062)
(NASA-CR-140573; SU-IPR-592) Avail: NTIS HC $4.00 CSCL 03B

It has been noted that coronal holes appear to be associated with regions of diverging magnetic field in the corona. It was undertaken to test the hypothesis that coronal holes may be caused by an increased flow of energy into the solar wind resulting directly from this diverging magnetic field pattern. Simple models were devised to approximate the energy flow down into the transition region and up into the solar wind as a function of the temperature, density, and rate of field line divergence in the corona. By assuming the rate of mechanical energy influx into the corona to be constant, it was then possible to solve numerically for the coronal temperature and density as a function of the rate of field line divergence. The results of these calculations demonstrate that a diverging field pattern can, indeed, bring about reductions in the temperature and density at the base of the corona comparable to those observed in coronal holes.
Author

N74-35217*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GAMMA RAY ASTROPHYSICS
F. W. Stecker Sep. 1974 126 p refs Presented at NATO Advanced Study Inst. on the Origin of Cosmic Rays, 26 Aug. - 6 Sep. 1974
(NASA-TM-X-70759; X-602-74-272) Avail: NTIS HC $9.50 CSCL 03B

Gamma ray production processes are reviewed, including Compton scattering, synchrotron radiation, bremsstrahlung interactions, meson decay, nucleon-antinucleon annihilations, and pion production. Gamma ray absorption mechanisms through interactions with radiation and with matter are discussed, along with redshifts and gamma ray fluxes. J.A.M.

N74-35218*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HIGH ENERGY GAMMA RAY RESULTS FROM THE SECOND SMALL ASTRONOMY SATELLITE
C. E. Fichtel, R. C. Hartman, D. A. Kniffen, D. J. Thompson, G. F. Bignami, H. Oegelman (Middle East Technical Univ.), M. F. Oezel (Middle East Technical Univ.), and T. Tuemer (Middle East Technical Univ.) Oct. 1974 80 p refs Submitted for

publication
(NASA-TM-X-70761; X-662-74-304) Avail: NTIS HC $7.00 CSCL 03B

A high energy (>35 MeV) gamma ray telescope employing a thirty-two level magnetic core spark chamber system was flown on SAS 2. The high energy galactic gamma radiation is observed to dominate over the general diffuse radiation along the entire galactic plane, and when examined in detail, the longitudinal and latitudinal distribution seem generally correlated with galactic structural features, particularly with arm segments. The general high energy gamma radiation from the galactic plane, explained on the basis of its angular distribution and magnitude, probably results primarily from cosmic ray interactions with interstellar matter. Author

N74-35219*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MEASURED AND CALCULATED NEUTRON SPECTRA AND DOSE EQUIVALENT RATES AT HIGH ALTITUDES; RELEVANCE TO SST OPERATIONS AND SPACE RESEARCH
Trutz Foelsche, Rosalind B. Mendell (New York Univ.), John W. Wilson, and Richard R. Adams Washington Oct. 1974 68 p refs
(NASA-TN-D-7715; L-9389) Avail: NTIS HC $3.75 CSCL 03B

Results of the NASA Langley-New York University high-altitude radiation study are presented. Measurements of the absorbed dose rate and of secondary fast neutrons (1 to 10 MeV energy) during the years 1965 to 1971 are used to determine the maximum radiation exposure from galactic and solar cosmic rays of supersonic transport (SST) and subsonic jet occupants. The maximum dose equivalent rates that the SST crews might recieve turn out to be 13 to 20 percent of the maximum permissible dose rate (MPD) for radiation workers (5 rem/yr). The exposure of passengers encountering an intense giant-energy solar particle event could exceed the MPD for the general population (0.5 rem/yr), but would be within these permissible limits if in such rare cases the transport descends to subsonic altitude; it is in general less than 12 percent of the MPD. By Monte Carlo calculations of the transport and buildup of nucleons in air for incident proton energies E of 0.02 to 10 GeV, the measured neutron spectra were extrapolated to lower and higher energies and for galactic cosmic rays were found to continue with a relatively high intensity to energies greater than 400 MeV, in a wide altitude range. This condition, together with the measured intensity profiles of fast neutrons, revealed that the biologically important fast and energetic neutrons penetrate deep into the atmosphere and contribute approximately 50 percent of the dose equivalant rates at SST and present subsonic jet altitudes. Author

N74-35220*# Pennsylvania Univ., Philadelphia.
ORIGIN OF COSMIC RAYS
Jeffrey M. Cohen and Reuven Ramaty 27 Feb. 1974 6 p refs Sponsored by NASA and AEC
(NASA-CR-140171; COO-3071-66; UPR-0026T) Avail: NTIS HC $4.00 CSCL 03B

A model is presented in which cosmic electrons are produced by pulsars, and cosmic protons and alpha particles are accelerated by shock waves in supernova envelopes. It is argued that neither mechanism by itself can produce both the observed protons and electrons at energies above a few hundred MeV. But supernova accelerated electrons could constitute the majority of cosmic electrons with energy below about 10 MeV. Author

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N74-35221 Wisconsin Univ., Madison.
THE CHEMICAL COMPOSITION OF SELECTED H 2 REGIONS IN THE MAGELLANIC CLOUDS Ph.D. Thesis
Reginald James Dufour 1974 150 p
Avail: Univ. Microfilms Order No. 74-16203

An investigation of the optical spectra and elemental abundances of 14 H II regions in the Large (LMC) and Small (SMC) Magellanic Clouds is presented. The relative abundances of hydrogen, helium, nitrogen, oxygen, neon, sulphur, chlorine, and argon are calculated. Also the effects of temperature and density fluctuations are discussed. Elemental abundances for the observed H II regions in the Magellanic Clouds are calculated. The abundances of the SMC and LMC H II regions are compared to the Orion Nebula. The LMC H II regions are deficient in oxygen, neon, sulphur, and argon by 20%-50% and deficient in chlorine and nitrogen by factors of about 4 and 6, respectively. The SMC H II regions are found to be deficient in sulphur and argon by a factor of about 2; deficient in oxygen and neon by a factor of about 3; and deficient in nitrogen by a factor of about 11. The helium abundances in the H II regions of the SMC and LMC ar similar to the Orion Nebula. Dissert. Abstr.

N74-35222 Pennsylvania State Univ., University Park.
MANY-BODY PLASMA CORRECTIONS TO STELLAR THERMONUCLEAR REACTION RATE Ph.D. Thesis
Calvin Morse Burgoyne 1974 105 p
Avail: Univ. Microfilms Order No. 74-20989

Stellar thermonuclear reaction rate equations are reformulated in such a way that the effects of the stellar plasma can be included in a systematic way. The reaction rates are written in terms of the plasma charge density propagator. The static limit of the plasma charge density propagator is taken to give the Salpeter electron weak screening theory. Dynamic effects of the plasma on thermonuclear reaction rates are investigated and explicit reaction rate formulas are given. It is found that dynamic effects of the plasma do not make significant changes in thermonuclear reaction rates. It is suggested that the general methods developed in this work can be applied to other types of reactions such as beta-decay where dynamic effects of the plasma may be important. Dissert. Abstr.

N74-35223 California Univ., Los Angeles.
ENERGETIC ELECTRONS IN THE NEAR GEOMAGNETIC TAIL AND AT SYNCHRONOUS ORBIT: SPATIAL DISTRIBUTIONS AND ACCELERATION MECHANISMS Ph.D. Thesis
Raymond John Walker 1973 133 p
Avail: Univ. Microfilms Order No. 74-11589

The results of a study of the energetic (E>50 kev) electron population in the near geomagnetic tail and a model for the acceleration of outer radiation zone electrons are presented. Energetic electron data and magnetic field data from electron spectrometer and fluxgate magnetometer experiments on OGO-5 formed the basis for the magnetotail electrons study. The spatial distribution of energetic plasma sheet electrons out to a radial distance of 24 Re is presented. The energetic electron population is of nearly constant thickness as a function of the solar magnetospheric Y coordinate. This observation contrasts those from the Vela satellites in which the distribution thickens near the dawn magnetopause. Dissert. Abstr.

N74-35224 California Univ., San Diego.
TWO ASTROPHYSICAL APPLICATIONS OF KINETIC THEORY; JET STREAM FORMATION THROUGH ELASTIC COLLISIONS: PLASMA OSCILLATIONS IN THE MAGNETOSPHERE Ph.D. Thesis
David Coffin Baxter 1974 96 p
Avail: Univ. Microfilms Order No. 74-17702

A Boltzmann-type equation is used to examine the effects of inelasticity on scattering between particles in Kepler orbits. A Fokker-Planck equation is found which predicts either radial clustering or diffusion. The observation and analysis of oscillations with periods of hundreds of seconds in the magnetospheric plasma at 6.6 earth-radii, are discussed. Dissert. Abstr.

N74-35225 California Univ., Los Angeles.
QUIET-TIME CURRENTS AND ELECTRIC FIELDS PRODUCED BY THE IONOSPHERIC DYNAMO Ph.D. Thesis
John Phillip Schieldge 1974 122 p
Avail: Univ. Microfilms Order No. 74-12472

The global magnetic variations on a number of magnetically

quiet days are simulated using a model of the ionospheric dynamo that allows currents to flow freely along field lines between hemispheres and a model of the equatorial electrojet. The ionospheric dynamo is driven by a combination of tidal winds (the diurnal(1,-2) and semi-diurnal (2,2), (2,3), (2,4) modes) objectively determined from an analysis of the actual data. The winds vary with height and include the dissipative effects of molecular viscosity, molecular heat conductivity, and ion drag. A realistic model of the global conductivity distribution is used. In the simulation, the eastward equatorial electric field derived from the global dynamo model is used to compute the electrojet currents and associated magnetic variations. The results of the simulation indicate the winds driving the dynamo have a universal time component. Furthermore, the study shows the importance of the semi-diurnal tidal winds in driving the dynamo.
Dissert. Abstr.

N74-35226 California Inst. of Tech., Pasadena.
CHEMISTRY, NUCLEAR: NEUTRON STRATIGRAPHY IN THE LUNAR REGOLITH Ph.D. Thesis
Guston Price Russ, III 1974 343 p
Avail: Univ. Microfilms Order No. 74-17955

Differences in the isotopic composition of Gd and Sm among lunar samples collected during the Apollo 11, 12, 14, 15 and 16 and Luna 16 missions were measured by high precision mass spectrometry. These differences can be attributed unambiguously to low energy neutron capture reactions and correspond to neutron fluences as high as 10 to the 17th power n/sq cm. For the Apollo 16 samples, enrichments are reported for the Gd-162 Gd-160 ratio which appear to be due to neutron capture by Eu-151. The measured ratio of the number of neutrons captured per atom by Sm-149 to the number captured per atom by Gd-157 indicates that the low energy lunar neutron spectrum is in reasonable agreement with that calculated by Lingenfelter, Canfield, and Hampel but that the lunar spectrum is somewhat harder. A synthesis of all the available lunar neutron capture data Gd-157, Gd-155, Sm-149, Eu-151, Co-59, Br-79, Ba-130, W-186, U-235, U-238, and Ca-40 indicates that only the W-186 and U-235 data are incompatible with the LCH neutron spectrum flux. Dissert. Abstr.

N74-35227 Auburn Univ., Ala.
A NUMERICAL PREDICTION OF THE HEATING AND RADIATION OF SMALL ARTIFICIAL METEORS ENTERING THE EARTH'S ATMOSPHERE Ph.D. Thesis
Thurman Dwayne McCay 1974 153 p
Avail: Univ. Microfilms Order No. 74-19389

Current numerical methods were employed to seek solutions in four problem areas: (1) meteor preheating, (2) flow interaction between the ablating meteor material and the air stream, (3) radiation from the high temperature metallic gas surrounding the meteor, and (4) detection of the emitted radiation at the earth's surface. Numerical results are presented for 0.1 cm diameter pure iron and pure nickel artificial meteors which have been accelerated by shaped charges to a velocity of 12 km/sec at an initial altitude of 80 km. The temperature distribution within the meteors is determined as a function of time for the nonrotating case. The temperature difference between front and rear face is found to be small (250 K) for the non-rotating case and even smaller when rotation is considered. Dissert. Abstr.

N74-35228 Rice Univ., Houston, Tex.
PLASMA DEPLETION NEAR A MAGNETOSPHERIC BOUNDARY Ph.D. Thesis
Bryan Joseph Zwan 1974 186 p
Avail: Univ. Microfilms Order No. 74-21351

A mathematical model is presented which describes the process whereby plasma is squeezed out along interplanetary field lines resident in the region between the shock and the effective obstacle of a planetary body. The net effect of this squeezing process is to leave a region shockward of the magnetospheric boundary depleted of plasma. Numerical solutions are obtained for the dimensionless magnetohydrodynamic conservation equations describing this process. It is shown that the solutions depend only on the dimensionless parameter xi, which is the ratio of the initial magnetic pressure to the total external pressure measured just post shock. Dissert. Abstr.

N74-35229 Rice Univ., Houston, Tex.
THE INFLUENCE OF THE VARIANCE OF THE INTERPLANETARY MAGNETIC FIELD ON GEOMAGNETIC ACTIVITY Ph.D. Thesis
Henry Berry Garrett 1974 144 p
Avail: Univ. Microfilms Order No. 74-21273

Hourly values of several solar wind and interplanetary magnetic field (IMF) parameters are compared to the AE and ap geomagnetic indices. It is found that the average value of the southward component of the IMF correlates the best with hourly values of AE and (smoothed) values of the three hour ap index. Improvement in these correlations (about 5 per cent) was effected by multiplying the southward component by the bulk velocity of the solar wind (the resulting quantity is proportional to the dawn to dusk electric field generated by the solar wind plasma as it moves past the earth). Further improvement (another 5 per cent) was accomplished by introducing the variance of the IMF. This result indicated that the solar wind could merge or transfer energy more efficiently to the magnetosphere when the IMF (or equivalently, the interplanetary electric field) was fluctuating in a frequency range from 5 minutes to an hour.
Dissert. Abstr.

N74-35230 Rice Univ., Houston, Tex.
OBSERVATIONS OF MAGNETOSHEATH PLASMA AT THE LUNAR ORBIT Ph.D. Thesis
Martha Ann Fenner 1974 239 p
Avail: Univ. Microfilms Order No. 74-21267

Ten months of data are compiled to define the general sheath structure. Plasma parameters of pressure and temperature follow the predictions of laminar flow. Turbulence, indicated by the diffusion of particles into a high energy tail is observed to increase near the bow shock in the dusk sheath. This result confirms the presence of particle interactions with the waves that have been reported to be a maximum at the bow shock. Turbulence in the dusk sheath is observed to correlate with geomagnetic activity. The dawn sheath shows no such correlation. The ordered structure of the dusk parameters and the correlation with Kp indicate an asymmetry of the two sides of the magnetosheath. Such an asymmetry has been observed before in the shock structure, and boundary motions, but not in plasma data. Magnetosheath-like spectra are observed just inside the magnetopause and farther out in the tail. Dissert. Abstr.

N74-35231 Colorado Univ., Boulder.
THE APPLICATION OF SECULAR STABILITY ANALYSIS TO SEVERAL ASTROPHYSICAL PROBLEMS Ph.D. Thesis
Richard Anthony Siquig 1974 230 p
Avail: Univ. Microfilms Order No. 74-22393

Secular stability analysis has been used: (1) to solve an outstanding puzzle in astrophysics, namely the so-called solar neutrino problem; (2) for investigating the stability properties of multiple solutions to the equations of stellar structure. Several other topics were briefly considered: the inclusion of abundance perturbations in secular analysis; the significance of non-equilibrium of He3 in the secular analysis of the completely convective stars of the lower main sequence; a recently developed computer program that permits the simultaneous determination of the eigenvalues of the secular problem. Dissert. Abstr.

N74-35232 California Inst. of Tech., Pasadena.
APPLICATIONS OF A NUCLEAR TECHNIQUE FOR DEPTH SENSITIVE HYDROGEN ANALYSIS: TRAPPED H IN LUNAR SAMPLES AND THE HYDRATION OF TERRESTRIAL OBSIDIAN Ph.D. Thesis
Douglas Albert Leich 1974 198 p
Avail: Univ. Microfilms Order No. 74-21598

A resonant nuclear reaction has been used to perform depth-sensitive analyses for both fluorine and hydrogen in solid samples. The resonance at 0.83 MeV (center-of-mass) in this reaction has been applied to the measurement of the distribution of trapped solar protons in lunar samples to depths of approximately 1/2 micron. These results are interpreted in terms of a redistribution of the implanted H which has been influenced by heavy radiation damage in the surface region. Fluorine determinations have been performed in a 1-micron surface layer on lunar and meteoritic samples using the same resonance. The measurement of H depth distribution has also been used to

study the hydration of terrestrial obsidian, a phenomenon of considerable archaeological interest as a means of dating obsidian artifacts. Additional applications of this type of technique are also discussed. Dissert. Abstr.

N74-35233 Colorado Univ., Boulder.
AN ANALYSIS OF THE EFFECTS OF SYSTEMATIC ERRORS IN THE LUNAR RANGING EXPERIMENT Ph.D. Thesis
James Pryor Hauser 1974 92 p
Avail: Univ. Microfilms Order No. 74-22352

A model for the topocentric distance from McDonald Observatory to the Apollo 11 site is constructed. The effects of systematic errors in the laser measurement of this distance on the determination of the model parameters are then investigated. Several expressions for the parameter uncertainties are derived using different assumptions about the range errors. Included is one case which assumes only that the sources of the periodicities in the range errors are independent, and that there is an approximate upper bound on the error at any time. This is contrasted with the usual assumption that the range errors themselves are independent. The resulting expressions are used to compute values for the uncertainties of the desired parameters in the lunar ranging problem. Dissert. Abstr.

N74-35234 Arizona Univ., Tucson.
CLOUD STRUCTURE IN THE SOUTH TROPICAL ZONE, RED SPOT AND NORTH POLAR REGION OF JUPITER Ph.D. Thesis
Arthur Earhart Clements 1974 119 p
Avail: Univ. Microfilms Order No. 74-23376

Observational and theoretical methods were used to derive parameters for three Jupiter regions having different structures. Regional observations were obtained by area scanning in two wavelength passbands (each 100 A wide), one centered at 8880 A and lying within a rather strong absorption band of methane, the other centered at 9215 A and lying in a region free of significant molecular absorption. On May 10, 1971, during a 5-hour period between the rise and set of the Red Spot, Jupiter was repeatedly scanned along a line through the Spot's center and parallel to the equator, and intensity profiles of the South Tropical Zone containing the Spot at various stages of its transit of the disk were accumulated. After the Spot had set, the North Polar Region was similarly scanned. Star observations were made to provide calibration and to monitor seeing. Reduction of these observations yielded accurate limb-darkening curves on an absolute intensity scale for each region and wavelength. Dissert. Abstr.

N74-35235*# TRW Systems Group, Redondo Beach, Calif. Dept. of Space Sciences.
STUDY OF THE RELATION BETWEEN Pc 3 MICROPULSATIONS AND MAGNETOSHEATH FLUCTUATIONS AND FOR THE MULTISATELLITE MULTIMEASUREMENT INVESTIGATION OF EARTHS BOW SHOCK Final Report, Jul. 1973 - Jul. 1974
Eugene W. Greenstadt Jul. 1974 143 p refs
(Contract NASw-2398)
(NASA-CR-140183; Rept-21333-6016-RU-00) Avail: NTIS HC $4.75 CSCL 03B

Hourly averages of HEOS A interplanetary field and plasma parameters are compared with micropulsation spectrograms taken by auroral zone stations. Visual evaluation of tungsten induction coil records and a statistical summary indicate a class of pulsations sometimes in the Pc 3, sometimes in the Pc 4 range, whose appearance correlates with solar wind field flow alignment. It is concluded that there is a pulsation phenomenon of variable period strongly associated with certain interplanetary field directions. G.G.

N74-35236*# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
OBSERVATION OF SOFT X-RAYS FROM EXTENDED SOURCES Final Report
R. C. Catura and L. W. Acton 30 Jun. 1974 15 p refs
(Contract NASw-2414)
(NASA-CR-140516) Avail: NTIS HC $4.00 CSCL 03B

Efforts were directed toward surveying several supernova remnants for the emission of soft X-rays. Rather than attempt to detect such faint X-ray emission, the program was redirected to observe the spectrum and angular structure of the extended X-ray source in the Perseus cluster of galaxies and the supernova remnant Puppis A. An attempt was made to detect X-ray line emission from Puppis A with a Bragg crystal spectrometer. Observations provide evidence for the presence of X-ray line emission in the spectrum of Puppis A near .65 keV. Author

N74-35237*# Teledyne Brown Engineering, Huntsville, Ala.
SKYLAB NEUTRON ENVIRONMENT EXPERIMENT (SCIENCE DEMONSTRATION SD-34 (TV108)). DESCRIPTION AND PRELIMINARY RESULTS Interim Report
G. J. Fishman Apr. 1974 24 p
(Contract NAS8-26342)
(NASA-CR-120446; EE-SSL-1802) Avail: NTIS HC $4.25 CSCL 03B

Neutron and proton induced radioactivity at various locations within Skylab were measured. Samples of five metals were formed into activation packets and deployed at the following locations on the Skylab 4 mission: orbital workshop film vault, water storage tank, and two opposing orbital workshop internal locations. Radioactive nuclides were produced in the packets by nuclear interactions of high-energy protons and secondary neutrons within Skylab. Low-level gamma ray spectroscopy measurements were made on the returned packets to determine the incident neutron and proton fluxes and spectra and their variations with mass distribution. Author

N74-35238*# RAND Corp., Santa Monica, Calif.
MARINER 9 CONTROL NET OF MARS: MAY 1974
Merton E. Davies May 1974 107 p refs
(Contract NASw-2563)
(NASA-CR-140406; R-1525-NASA) Avail: NTIS HC $8.50 CSCL 03C

Aerographic and aerocentric coordinates are given for 2061 primary control points on the surface of Mars. Author

N74-35239*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SKYLAB MISSION REPORT, THIRD VISIT
Jul. 1974 337 p refs
(NASA-TM-X-70385; JSC-08963) Avail: NTIS HC $20.00 CSCL 22C

An evaluation is presented of the operational and engineering aspects of the third Skylab visit, including information on the performance of the command and service module and the experiment hardware, the crew's evaluation of the visit, and other visit-related areas of interest such as biomedical observations. The specific areas discussed are contained in the following: (1) solar physics and astrophysics investigations; (2) Comet Kohoutek experiments; (3) medical experiments; (4) earth observations, including data for the multispectral photographic facility, the earth terrain camera, and the microwave radiometer/scattermometer and altimeter; (5) engineering and technology experiments; (6) food and medical operational equipment; (7) hardware and experiment anomalies; and (8) mission support, mission objectives, flight planning, and launch phase summary. Conclusions discussed as a result of the third visit to Skylab involve the advancement of the sciences, practical applications, the durability of man and systems in space, and spaceflight effectiveness and economy. A.A.D.

N74-35240*# Planetary Science Inst., Tucson, Ariz.
SPECTROPHOTOMETRIC STUDY OF ASTEROIDS Final Report
C. R. Chapman Aug. 1974 17 p refs
(Contract NASw-2522)
(NASA-CR-140511) Avail: NTIS HC $4.00 CSCL 03B

Observations of particular faint asteroids of interest, in particular the Trojans, were carried out during an observation run at Kitt Peak National Observatory (1.3 meter telescope) in September 1973, and an attempt was made to study the compositional variation within Hirayama families. A particularly important study was initiated to observe spectrophotometrically certain asteroids which are considered as potential source bodies for meteorites. A program was also undertaken to coordinate the spectrophotometry program with polarimetric and thermal-

infrared observation programs being conducted elsewhere.
Author

N74-35241*# Earth Sciences Research, Inc., Cambridge, Mass.
RESEARCH ON THE THERMAL HISTORY OF THE MOON Final Report, Jun. 1971 - Aug. 1973
Jul. 1974 68 p refs
(Contract NAS9-11968)
(NASA-CR-140257) Avail: NTIS HC $6.50 CSCL 03B

Lunar thermal history modelling is used to demonstrate that a realistic computer simulation can be used to predict major and minor element concentrations, thickness of the lunar crust, and intensity of volcanic activity as a function of time. The models which are most consistent with the observations include: (1) a high surface temperature and low interior temperature during the very early lunar history; (2) high near-surface radioactivity and relatively low radioactivity in the interior; and (3) a molten zone formed at or near the surface which gradually migrates downward with time. Lunar magnetic anomaly calculations show that large anomalies measured at some of the landing sites and above some points on the surface cannot be caused by mere basalts but are consistent with valley fillings of Cayley-like material with a remanent magnetization of about 0.0002 emu/gm. Author

N74-35242*# Scientific Translation Service, Santa Barbara, Calif.
METHOD OF DETERMINING OPTIMAL SPACECRAFT TRAJECTORY CORRECTION
V. A. Kuzminykh Washington NASA Oct. 1974 14 p refs Transl. into ENGLISH from the Russian preprint-168
(Contract NASw-2483)
(NASA-TT-F-15963; Preprint-168) Avail: NTIS HC $4.00 CSCL 22C

An optimal spacecraft trajectory correction method is examined. The method consists of determining the optimal energetics and strategy for interplanetary spacecraft trajectory correction. Calculations for the Earth-Jupiter flight trajectory are presented. Author

N74-35243*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MSFC SKYLAB KOHOUTEK PROJECT REPORT
Oct. 1974 189 p refs
(NASA-TM-X-64880) Avail: NTIS HC $5.50 CSCL 03B

Skylab 4 experiment's selection for observing of the Comet Kohoutek, 1973f is documented. The report also reflects premission planning versus the actual experiment performance based upon the changing cometary parameters. The experiment concepts, hardware, operational performance and anaomalies are discussed. Experiments which viewed the comet were mainly through the SAL and ATM, but some were handheld and EVA. A complete astronaut commentary appears as appendixes.
Author

N74-35244*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
FOUR STOKES PARAMETER RADIO FREQUENCY POLARIMETRY OF A FLARE FROM AD LEONIS
Steven R. Spangler, John M. Rankin, and Stanley D. Shawhan Jul. 1974 19 p refs
(Grants NGL-16-001-002; NSF GA-37827; NSF GP-26549) (NASA-CR-140520; U-of-Iowa-74-32) Avail: NTIS HC $4.00 CSCL 03A

Observations of the four Stokes parameters of a 430 MHz flare from the UV Ceti-type star AD Leonis are presented. The maximum amplitude of the event was 0.52 flux units and the durations at one-half and one-tenth maximum were 12 and 40 seconds, respectively. The degree of circular polarization at maximum intensity was approximately 56 percent and was later observed to be as high as 92 percent. Linear polarization was also observed at a level of about 21 percent at flare maximum which allowed an upper limit of 440 radians - sq m to be placed on the rotation measure. Author

N74-35245*# California Inst. of Tech., Pasadena. Div. of Physics, Mathematics and Astronomy.
HIGH ANGULAR RESOLUTION COSMIC X-RAY ASTRONOMY OBSERVATIONS IN THE ENERGY RANGE 0.15-2 keV AND XUV OBSERVATIONS OF NEARBY STARS FROM AN ATTITUDE CONTROLLED ROCKET Annual Report, 1 Sep. 1973 - 31 Aug. 1974
Gordon P. Garmire 31 Aug. 1974 46 p refs
(Grant NGR-05-002-284)
(NASA-CR-140408) Avail: NTIS HC $5.50 CSCL 03A

The construction of a two dimensional focusing Wolter Type I mirror system for X-ray and XUV astronomical observations from an Astrobee F sounding rocket is described. The mirror design goal will have a one degree field, a 20-arc seconds resolution, an effective area of about 50 sq cm at 1 keV and 10 sq cm at 0.25 keV on axis. A star camera provides aspect data to about 15-arc seconds. Two detectors are placed at the focus with an interchange mechanism to allow a detector change during flight. The following specific developments are reported: (1) position sensitive proportional counter development; (2) channel plate multiplier development; (3) telescope mirror development and payload structure; (4) Australian rocket flight results; (5) Comet Kohoutek He I observation; and (6) Vela, Puppis A, and Gem-Mon bright patch observations. Author

N74-35246*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AN ILLUSTRATED CHRONOLOGY OF THE NASA MARSHALL CENTER AND MSFC PROGRAMS 1960-1973
David S. Akens May 1974 438 p refs
(NASA-TM-X-70382; MHR-10) Avail: NTIS HC $9.00 CSCL 22C

The role that NASA's Marshall Space Flight Center played in the space program during the past 13 years is highlighted with pictures and text, plus background information concerning events that were important in the center's formation. Author

N74-35247*# Arizona Univ., Tucson.
CONTINUED DEVELOPMENT AND APPLICATION OF FAR-INFRARED DETECTION TECHNIQUES Final Report, 1 Jun. 1973 - 31 May 1974
Frank J. Low 31 May 1974 11 p refs
(Grant NGR-03-002-269)
(NASA-CR-140575) Avail: NTIS HC $4.00 CSCL 03A

The development of a balloon gondola and pointing system are discussed which can be used with the low background far infrared telescope. Flight test progress of the new gondola is reported using a 3-axis system which would provide much greater capabilities. In this design both a polar and declination axis are use and are maintained in the proper orientation by a free handing (vertical) azimuth shaft. M.C.F.

N74-35248*# Northrop Services, Inc., Huntsville, Ala.
APPLICATION OF MARKOV CHAIN THEORY TO ASTP NATURAL ENVIRONMENT LAUNCH CRITERIA AT KENNEDY SPACE CENTER
M. E. Graves and M. Perlmutter Sep. 1974 29 p refs
(Contract NAS8-21810)
(NASA-CR-129044) Avail: NTIS HC $3.25 CSCL 22D

To aid the planning of the Apollo Soyuz Test Program (ASTP), certain natural environment statistical relationships are presented, based on Markov theory and empirical counts. The practical results are in terms of conditional probability of favorable and unfavorable launch conditions at Kennedy Space Center (KSC). They are based upon 15 years of recorded weather data which are analyzed under a set of natural environmental launch constraints. Three specific forecasting problems were treated: (1) the length of record of past weather which is useful to a prediction; (2) the effect of persistence in runs of favorable and unfavorable conditions; and (3) the forecasting of future weather in probabilistic terms. Author

N74-35249*# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
RESEARCH STUDY ON MATERIALS PROCESSING IN SPACE EXPERIMENT NUMBER M512 Final Report on M551, M552, and M553
J. Martin Tobin and Ram Kossowsky Dec. 1973 30 p refs
(Contract NAS8-28730)
(NASA-CR-120479) Avail: NTIS HC $3.25 CSCL 13H

Adhesion of the melted metals to the adjacent solid metals, and cohesion of the liquid metal to itself appeared to be equally

as strong in zero gravity as on earth. Similar cut edge bead periodicity in cut thin plate, and similar periodic chevron patterns in full penetration welds were seen. The most significant practical result is that the design of braze joints for near zero gravity can be very tolerant of dimensional gaps in the joint. This conclusion is based on a comparison of narrow, wide and variable gap widths. Brazing is very practical as a joining or repairing technique for metal structures at zero gravity. The operation of the hardware developed to locate successive small (0.6 cm) diameter cylinders in the focus of the battery powered EB unit, melt the various metal specimens and deploy some liquid metal drops to drift in space, was generally successful. However, the sphericity and surface roughness were far from those of ball bearings. Author

N74-35250*# Kansas Univ. Center for Research, Inc., Lawrence. Space Technology Center.
THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION INTERDISCIPLINARY STUDIES IN SPACE TECHNOLOGY AT THE UNIVERSITY OF KANSAS Final Report
B. G. Barr Sep. 1974 163 p refs
(Grant NGL-17-002-001)
(NASA-CR-140623) Avail: NTIS HC $11.25 CSCL 22A

A broad range of research projects contained in a cooperative space technology program at the University of Kansas are reported as they relate to the following three areas of interdisciplinary interest. (1) remote sensing of earth resources; (2) stability and control of light and general aviation aircraft; and (3) the vibrational response characteristics of aeronautical and space vehicles. Details of specific research efforts are given under their appropriate departments, among which are aerospace engineering, chemical and petroleum engineering, environmental health, water resources, the remote sensing laboratory, and geoscience applications studies. A.A.D.

N74-35251# Committee on Science and Astronautics (U. S. House).
TRACKING AND DATA ACQUISITION PROGRAM
William G. Wells, Jr., Elliott H. Bushlow, Harold A. Gould, Thomas N. Tate, and Patricia Schwartz Washington GPO 1974 71 p refs Rept. prepared by Subcomm. on Aeron. and Space Technol. of Comm. on Sci. and Astronaut., 93d Congr., 2d Sess., 26 Sep. 1974
(GPO-39-138) Avail: Subcomm. on Aeron. and Space Technol.

An analysis of the NASA Tracking and Data Acquisition program is reported. An overview of the program is presented, and the relationships of the NASA T and DA programs with other U.S. agencies and foreign nations are discussed. Plans and proposals for future tracking and data relay systems are included. F.O.S.

N74-35252# Joint Publications Research Service, Arlington, Va.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 333
30 Sep. 1974 40 p Transl. into ENGLISH from Russian reports
(JPRS-63092) Avail: NTIS HC $5.00

Translations and abstracts of articles on meteorology, oceanography, upper atmosphere and space research, astronomy and terrestrial geophysics, covering both science news and formal scientific reports are presented. Published details of Soviet space spectaculars are included. Author

N74-35253# Royal Greenwich Observatory, Herstmonceux (England).
GREENWICH TIME REPORT: ROYAL GREENWICH OBSERVATORY TIME AND LATITUDE SERVICE, JULY - DECEMBER 1973
Dec. 1973 31 p
Avail: NTIS HC $4.75

Results of the Greenwich Time and Latitude Service for the period July to December 1973 are reported in tabular form. Author

N74-35254*# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
THEORETICAL RESEARCHES INTO PLANETARY ATMOSPHERES AND THEIR INFLUENCE UPON SURFACE FEATURES Final Report, 15 Jun. 1972 - 1 Oct. 1974
Richard Goody 1 Oct. 1974 20 p refs
(Grant NGR-22-007-242)
(NASA-CR-140188) Avail: NTIS HC $4.00 CSCL 03B

The interface between certain geological and atmospheric phenomena on Mars was studied by examining those geological features which are associated with the presence of water in the liquid or solid phases. Several classes of Martian surface features thought to have had their origins in flow processes were studied in order to determine the role ice may have played in their creations. Preliminary studies concerning the behavior of Martian ice shelves were conducted, with the conclusion that flow rates of Martian and earth ice sheets are similar. Withdrawal of subsurface ice was found to be among the explanations for the origins of the chaotic terrains and drifted blocks. Author

N74-35255*# Hughes Aircraft Co., El Segundo, Calif. Space and Communications Group.
PIONEER MARS SURFACE PENETRATOR MISSION. MISSION ANALYSIS AND ORBITER DESIGN
Aug. 1974 90 p refs
(Contract NAS2-8424)
(NASA-CR-137568; SCG-40274R; D2546) Avail: NTIS HC $7.50 CSCL 22A

The Mars Surface Penetrator mission was designed to provide a capability for multiple and diverse subsurface science measurements at a low cost. Equipment required to adapt the Pioneer Venus spacecraft for the Mars mission is described showing minor modifications to hardware. Analysis and design topics which are similar and/or identical to the Pioneer Venus program are briefly discussed. M.C.F.

N74-35256*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DATA CATALOG OF SATELLITE EXPERIMENTS: IONOSPHERIC PHYSICS, METEOROLOGY, AND PLANETARY ATMOSPHERES, SUPPLEMENT 2A TO NSSDC-71-20
Leland L. Dubach Oct. 1974 107 p refs
(NASA-TM-X-72531; NSSDC-74-15A) Avail: NTIS HC $8.50 CSCL 03B

The purposes of the data catalog are to announce the availability of experimental space science data, to describe these data, and to inform potential users of the policies and procedures associated with data dissemination services. Author

N74-35257*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPARISON OF THE TRAPPED ELECTRON MODELS AE-4 AND AE-5 WITH AE-2 AND AE-3
Robert H. Hilberg, Michael J. Teague, James I. Vette, and Margaret L. King Sep. 1974 41 p refs
(NASA-TM-X-72532; NSSDC-74-13) Avail: NTIS HC $5.25 CSCL 03B

Models of geomagnetically trapped electrons are compared to estimate mission flux changes. The differences in the model environments were caused by a change in both the existing environment and the available data from which the models were derived. Different data analysis techniques have also influenced the models. This report compares the dependence of the flux to each of the relevant variables. To show the effects of the model differences, included are a comparison of orbital flux integrations for a range of orbits. M.C.F.

N74-35258*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INVESTIGATION OF NEW RADAR-DATA-REDUCTION TECHNIQUES USED TO DETERMINE DRAG CHARACTERISTICS OF A FREE-FLIGHT VEHICLE
Gerald E. Woodbury and John W. Wallace Washington Oct. 1974 50 p refs
(NASA-TN-D-7710; L-8398) Avail: NTIS HC $3.25 CSCL 05B

An investigation was conducted of new techniques used to determine the complete transonic drag characteristics of a series

of free-flight drop-test models using principally radar tracking data. The full capabilities of the radar tracking and meteorological measurement systems were utilized. In addition, preflight trajectory design, exact kinematic equations, and visual-analytical filtering procedures were employed. The results of this study were compared with the results obtained from analysis of the onboard, accelerometer and pressure sensor data of the only drop-test model that was instrumented. The accelerometer-pressure drag curve was approximated by the radar-data drag curve. However, a small amplitude oscillation on the latter curve precluded a precise definition of its drag rise. Author

N74-35259# Royal Aircraft Establishment, Farnborough (England).
THOUGHTS ON TRANSFER TO GEOSTATIONARY ORBIT BY ION PROPULSION-APPLICATION TO THE EUROPA 3 LAUNCHER
M. Gillr and P. Luquet Jul. 1974 41 p refs Transl. into ENGLISH from the French Presented at the LAAS Conf. on Elec. Propulsion in its Space Appl., Toulouse, 1972.
(RAE-Lib-Trans-1776; BR42983) Avail: NTIS HC $5.25

The order of magnitude was established for the capability of communications satellites to transfer to a geostationary orbit using their own ion propulsion power sources. Performances are given for interplanetary transfers, and the parametric results are applied to the Europa 3 launcher. Author

N74-35260*# Science Applications, Inc., Rolling Meadows, Ill.
ADVANCED PLANNING ACTIVITY Summary Report, 1 Feb. 1973 - 31 Jan. 1974
25 Feb. 1974 98 p refs
(Contract NASw-2494)
(NASA-CR-140407; SAI-120-M2) Avail: NTIS HC $8.00 CSCL 22A

Selected mission concepts for interplanetary exploration through 1985 were examined, including: (1) Jupiter orbiter performance characteristics; (2) solar electric propulsion missions to Mercury, Venus, Neptune, and Uranus; (3) space shuttle planetary missions; (4) Pioneer entry probes to Saturn and Uranus; (5) rendezvous with Comet Kohoutek and Comet Encke; (6) space tug capabilities; and (7) a Pioneer mission to Mars in 1979. Mission options, limitations, and performance predictions are assessed, along with probable configurational, boost, and propulsion requirements. A.A.D.

N74-35261*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ROTATIONAL BURSTING OF INTERPLANETARY DUST PARTICLES
Stephen J. Paddack and John W. Rhee Sep. 1974 8 p refs Submitted for publication
(NASA-TM-X-70760; X-405-74-300) Avail: NTIS HC $4.00 CSCL 03B

Solar radiation pressure is discussed as a cause of rotational bursting, and of eventual elimination of asymmetric dust particles from the solar system, by a windmill effect. The predicted life span with this process for metallic particles with radii of 0.00001 to 0.01 cm ranges from 10 to 10,000 years. The effects of magnetic spin damping were considered. This depletion mechanism works faster than the traditional Poynting-Robertson effect by approximately one order of magnitude for metallic particles and about two orders of magnitude for nonmetallic particles. Author

N74-35262*# Intersonics, Inc., Chicago, Ill.
ACOUSTIC POSITIONING FOR SPACE PROCESSING EXPERIMENTS Final Report
R. R. Whymark 11 Sep. 1974 42 p refs
(Contract NAS8-30471)
(NASA-CR-120474) Avail: NTIS HC $5.25 CSCL 13H

An acoustic positioning system is described that is adaptable to a range of processing chambers and furnace systems. Operation at temperatures exceeding 1000 C is demonstrated in experiments involving the levitation of liquid and solid glass materials up to several ounces in weight. The system consists of a single source of sound that is beamed at a reflecting surface placed a distance away. Stable levitation is achieved at a succession of discrete energy minima contained throughout the volume between the reflector and the sound source. Several specimens can be handled at one time. Metal discs up to 3 inches in diameter can be levitated, solid spheres of dense material up to 0.75 inches diameter, and liquids can be freely suspended in l-g in the form of near-spherical droplets up to 0.25 inch diameter, or flattened liquid discs up to 0.6 inches diameter. Larger specimens may be handled by increasing the size of the sound source or by reducing the sound frequency. Autho:

N74-35263 Oulu Univ. (Finland).
MODULATION LANES IN THE DYNAMIC SPECTRA OF JUPITER'S DECAMETRIC RADIO EMISSION
Jorma J. Riihimaa 1974 41 p refs Prepared in cooperation with Colorado Univ., Boulder and Florida Univ., Gainesville
(Grant NSF GP-7956)
(Rept-413) Copyright. Avail: Issuing Activity

High-resolution dynamic spectra of Jupiter's decametric emission are discussed which exhibit lane patterns, referred to as modulation lanes. These appear tilted in the orthogonal time-frequency plane, and the sign and magnitude of their drift rate is determined by the central meridian longitude of System III at Jupiter. The lanes are recorded both on L and S bursts, giving rise to a relatively few basic spectra types. Their simultaneous appearance, however, produces rather complicated spectral events. The origin of the modulation lanes is unknown. A few possible mechanisms are suggested. Author

N74-35264*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A STUDY OF THE POSSIBLE CHARACTERISTICS OF A LOW-ALTITUDE ELECTRON LAYER IN THE MARTIAN ATMOSPHERE
H. Andrew Wallio Washington Oct. 1974 58 p refs
(NASA-TN-D-7729; L-9600) Avail: NTIS HC $3.75 CSCL 03B

The apparent diurnal Martian surface pressure variations, as deduced from radio occultation experiments, is discussed and explained as possibly arising from the effect of a low-altitude electron layer. Possible source and loss mechanisms for the low altitude electron layer are presented and discussed. Time dependent differential equations describing the electron layer are derived, and then integrated to investigate the electron distribution resulting from several processes that might occur in the atmosphere. It is concluded that the source mechanism is the sublimation of alkali atoms from a permanent dust layer, and that the dominant loss process must involve CO2 clustering about the alkali atoms. An electron layer is developed which explains the apparent diurnal surface pressure variation. Author

N74-35265*# Alabama Univ., Huntsville.
IDENTIFICATION AND EVALUATION OF EDUCATIONAL USES AND USERS FOR THE STS. EDUCATIONAL PLANNING FOR UTILIZATION OF SPACE SHUTTLE ED-PLUSS Final Research Report
Harry A. Engle and David L. Christensen Sep. 1974 131 p refs
(Contract NAS8-30737)
(NASA-CR-120514) Avail: NTIS HC $9.75 CSCL 22A

A planning and feasibility study to identify and document a methodology needed to incorporate educational programs into future missions and operations of the space transportation system was conducted. Six tasks were identified and accomplished during the study. The task statements are as follows: (1) potential user identification, (2) a review of space education programs, (3) development of methodology for user involvement, (4) methods to encourage user awareness, (5) compilation of follow-on ideas, and (6) response to NASA questions. Specific recommendations for improving the educational coverage of space activities are provided. Author

N74-35266# Naval Weapons Lab., Dahlgren, Va.
INTEGRATION MODIFICATIONS TO ACCOMMODATE SOLAR RADIATION DISCONTINUITIES
Larry K. Beuglass Jun. 1974 23 p ref
(AD-783027; NWL-TR-3155) Avail: NTIS CSCL 22/3

Discontinuities which appear in problems involving numerical integration may require special attention if a multistep algorithm is used. The report describes the changes which were made to

the ASTRO computer program in order to accommodate the discontinuities in the solar radiation pressure affecting a satellite as it enters and leaves the earth's shadow. Of particular interest is the improvement in the accuracy of an ephemeris by a factor of 40 at negligible cost in terms of additional computer time.
Author (GRA)

N74-34811 Joint Publications Research Service, Arlington, Va.
WORK OF THE SPECIALIZED SCIENTIFIC CONFERENCE SPACE SURVEYS FOR STUDYING THE EARTH AND PLANETS
V. L. Zaychenko *In its* Geodesy and Aerial Phot., 1972 (JPRS-63013) 19 Sep. 1974 p 168-173 Transl. into ENGLISH from Izv. Vyssch. Ucheb. Zaved., Geod. Aerofotos. (Moscow), no. 6, 1972 p 129-132 (For availability see N74-34798 24-13)

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also; 28 Propulsion Systems; and 32 Structural Mechanics.

N74-35267 New Hampshire Univ., Durham.
ANALYSIS OF THE 0.511 MeV RADIATION AT THE OSO-7 SATELLITE Ph.D. Thesis
Philip Patrick Dunphy 1974 138 p
Avail: Univ. Microfilms Order No. 74-21092

Observations of the 0.511 MeV positron-annihilation gamma ray detector on the OSO-7 satellite are presented, along with a description of the detector. Variables which affect the counting rate of this line are discussed. Local production if found to be important and a contribution from the earth is found to be in agreement with that measured by balloon borne detectors. An upper limit of .0076 photons per square centimeter per second is obtained for the quiet sun and a positive flux of .063 plus or minus .02 photons per square centimeter per second is obtained for the 3B flare of August 4, 1972. The width of this annihilation line gives an upper limit temperature for the annihilation region of approximately 6 times 10 to the 6th power degrees K.
Dissert. Abstr.

N74-35268 California Univ., Los Angeles.
PERTURBATION ANALYSIS OF THE FLAT SPIN RECOVERY OF A DUAL-SPIN SPACECRAFT Ph.D. Thesis
Jean Rene Gebman 1974 190 p
Avail: Univ. Microfilms Order No. 74-22947

Asymptotic perturbation methods are used to obtain an approximate analytical solution of these equations for the flat spin initial condition (steady spin about the spacecraft centroidal principal axis of maximum inertia), and a constant excess torque level (the motor torque in excess of the bearing torque remains constant). The analytical estimate of the error introduced by truncating the asymptotic solution is shown to be consistent with the observed differences between the perturbation solution and the numerical integration results for all 27 spacecraft designs considered. The perturbation analysis combines the earlier methods of matched asymptotic expansions with the more recent methods of multiple time scales to treat the three layers of interest. In addition, a technique is introduced for numerically integrating a parameter-free transition layer differential equation. Parameter-free initial conditions are determined by matching with an outer solution.
Dissert. Abstr.

N74-35269*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
IN-LINE TASK 57: COMPONENT EVALUATION Final Report
Jack C. Boykin Mar. 1974 381 p refs
(NASA-TM-X-70363; Rept-74-EG-13; JSC-08941) Avail: NTIS HC $22.25 CSCL 22B

Design analysis tests were performed on selected power switching components to determine the possible applicability of off-the-shelf hardware to space shuttles. Various characteristics were also evaluated in those devices to determine the most desirable properties for the space shuttle. For individual titles, see N74-35270 through N74-35274.

N74-35270* Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
REMOTE CONTROL CIRCUIT BREAKER EVALUATION TESTING c09
Lew M. Bemko *In* NASA. Lyndon B. Johnson Space Center In-Line Task 57 Mar. 1974 86 p refs Revised (For availability see N74-35269 24-31)
(Contract NAS9-12200)
(LEC-0921-Rev-A) CSCL 09A

Engineering evaluation tests were performed on several models/types of remote control circuit breakers marketed in an attempt to gain some insight into their potential suitability for use on the space shuttle vehicle. Tests included the measurement of several electrical and operational performance parameters under laboratory ambient, space simulation, acceleration and vibration environmental conditions.
Author

N74-35271* Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
EVALUATION REPORT FOR TOGGLE SWITCHES: MICRO SWITCH AND CUTLER-HAMMER MODELS PER MIL-S-3950 c09
Don Labberton *In* NASA. Lyndon B. Johnson Space Center In-Line Task 57 Mar. 1974 23 p (For availability see N74-35269 24-31)
(Contract NAS9-12200)
(LEC-1124) CSCL 09A

Several models of hermetically sealed toggle switches meeting the requirements of MIL-S-3950, were evaluated to determine the probability that they would withstand the environmental requirements of, and therefore be suitable for use on, the space shuttle vehicle. The evaluation was started with a comparison of the environmental requirements for space shuttle hardware. This was followed with in-house testing for those environments where a reasonably firm conclusion could not be drawn in the comparison. Space simulation, acceleration, and vibration testing were performed in-house.
Author

N74-35272* Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
EVALUATION REPORT FOR TOGGLE SWITCHES: TEXAS INSTRUMENTS, INC., APOLLO-TYPE, AND DAVEN MEASUREMENTS PART NUMBER 45000-XXX, JOB ORDER 32-139 c09
Don Labberton *In* NASA. Lyndon B. Johnson Space Center In-Line Task 57 Mar. 1974 27 p (For availability see N74-35269 24-31)
(Contract NAS9-12200)
(LEC-1667) CSCL 09A

A preliminary evaluation of environmental capabilities was undertaken on toggle switches and on Apollo-type toggle switches. The purpose of this evaluation was to take a first look at their tested capabilities for the purpose of determining whether the candidate hardware appears to have a good chance of successfully completing a detailed envrionmental qualification test program.
Author

N74-35273* Singer Co., Little Falls, N.J. Kearfott Div.
SOLID STATE SWITCH PANEL Final Report c09
E. Beenfeldt *In* NASA. Lyndon B. Johnson Space Center In-Line Task 57 Mar. 1974 116 p (For availability see N74-35269 24-31)
(Contract NAS9-13144)
(Y256A226) CSCL 09A

An intensive study of various forms of transducers was conducted with application towards hermetically sealing the transducer pick off and all electronics. The results indicated that the Hall effect devices and a LED/phototransistor combination were the most practical for this type of application. Therefore, hardware was developed utilizing a magnet/Hall effect transducer for single action switches and LED/phototransistor transducers for rotary multiposition or potentiometer applications. A number of switches were built and models were hermetically sealed to prove the feasibility of this type of fabrication. One of

each type of switch was subjected to temperature cycling, vibration, and EMI tests. Author

N74-35274* Teledyne Relays, Santa Monica, Calif.
SOLID STATE POWER CONTROLLERS Final Report c09
R. Stuart Gibbs *In* NASA. Lyndon B. Johnson Space Center In-Line Task 57 Mar. 1974 85 p (For availability see N74-35269 24-31)
(Contract NAS9-12914)
CSCL 09A

Solid state power controllers (SSPC's) are to be considered for use as replacements of electromechanical relays and circuit breakers in future spacecraft and aircraft. They satisfy the combined function of both the relay and circuit breaker and can be remotely controlled by small signals, typically 10 mA, 5 to 28 v(dc). They have the advantage over conventional relay/circuit breaker systems in that they can be located near the utilization equipment and the primary ac or dc bus. The low level control, trip indication and status signals can be circuited by small gauge wire for control, computer interface, logic, electrical multiplexing, onboard testing, power management, and distribution purposes. This results in increased system versatility at appreciable weight saving and increased reliability. Conventional systems require the heavy gage load wiring and the control wiring to be routed from the bus to the load to other remote relay contacts, switches, sensors, etc. and to the circuit breaker located in the flight engineer's compartment for purposes of manual reset. Author

N74-35275*# Chrysler Corp., New Orleans, La. Space Div.
RESULTS OF TESTS OF A 0.010- AND 0.015-SCALE MODELS OF SPACE SHUTTLE ORBITER CONFIGURATIONS 3 AND 3A IN THE AMES RESEARCH CENTER 3.5 FOOT HYPERSONIC WIND TUNNEL (OA23)
T. J. Dziubala (Rockwell Intern., Downey, Calif.), M. D. Milam (Rockwell Intern., Downey, Calif.), J. W. Cleary (NASA. Ames Research Center), and J. A. Mellenthin (NASA. Ames Research Center) Sep. 1974 762 p
(Contract NAS9-13247)
(NASA-CR-128799; DMS-DR-2071) Avail: NTIS HC $41.25 CSCL 22B

Longitudinal and lateral-directional stability and control characteristics were evaluated at Mach numbers of 5.3, 7.3 and 10.3 at angles of attack up to 50 degrees with Beta = 0 degrees and, for a few cases, Beta = 5 degrees. Component force data, fuselage base pressures and shadowgraph patterns were recorded. Author

N74-35276*# Chrysler Corp., New Orleans, La. Space Div.
RESULTS OF TRANSONIC/SUPERSONIC STATIC STABILITY WIND TUNNEL TESTS OF AN 0.004-SCALE SPACE SHUTTLE ORBITER MODEL (0A49)
Edward Allen Sep. 1974 1199 p Prepared by Rockwell Intern. Corp., Huntsville, Ala.
(Contract NAS9-13247)
(NASA-CR-134404; DMS-DR-2095) Avail: NTIS HC $63.00 CSCL 22B

Experimental aerodynamic investigations of the configuration 4 space shuttle orbiter were conducted in the 14-inch trisonic wind tunnel during November and December 1973. Elevon, aileron, bodyflap, speedbrake, rudder effectiveness, and effects of ventral fins were investigated at angles of attack from -10 deg to 40 deg, angles of sideslip from -10 deg to +10 deg, and Mach numbers from 0.6 to 4.96. Resulting six-component static stability data and associated test information are presented. Author

N74-35277*# Grumman Aerospace Corp., Bethpage, N.Y.
THERMAL STRESS ANALYSIS OF REUSABLE SURFACE INSULATION FOR SHUTTLE Final Report
I. U. Ojalvo, A. Levy, and F. Austin Sep. 1974 120 p refs
(Contract NAS1-10635)
(NASA-CR-132502) Avail: NTIS HC $4.50 CSCL 22B

An iterative procedure for accurately determining tile stresses associated with static mechanical and thermally induced internal loads is presented. The necessary conditions for convergence of the method are derived. An user-oriented computer program based upon the present method of analysis was developed. The program is capable of analyzing multi-tiled panels and determining the associated stresses. Typical numerical results from this computer program are presented. M.C.F.

N74-35278*# General Dynamics/Convair, San Diego, Calif.
EVALUATION OF COATED COLUMBIUM ALLOY HEAT SHIELDS FOR SPACE SHUTTLE THERMAL PROTECTION SYSTEM APPLICATION. VOLUME 3, PHASE 3: FULL SIZE TPS EVALUATION Technical Report, Feb. 1973 - Mar. 1974
J. W. Baer and W. E. Black Apr. 1974 162 p refs
(Contract NAS1-9793)
(NASA-CR-112119-3) Avail: NTIS HC $11.25 CSCL 22B

The thermal protection system (TPS), designed for incorporation with space shuttle orbiter systems, consists of one primary heat shield thermally and structurally isolated from the test fixture by eight peripheral guard panels, all encompassing an area of approximately 12 sq ft. TPS components include tee-stiffened Cb 752/R-512E heat shields, bi-metallic support posts, panel retainers, and high temperature insulation blankets. The vehicle primary structure was simulated by a titanium skin, frames, and stiffeners. Test procedures, manufacturing processes, and methods of analysis are fully documented. For Vol. 1, see N72-30948; for Vol. 2, see N74-15660. Author

N74-35279*# Rockwell International Corp., Downey, Calif. Space Div.
FRACTURE CONTROL METHODS FOR SPACE VEHICLES. VOLUME 1: FRACTURE CONTROL DESIGN METHODS Contractor Report, Jun. 1972 - Mar. 1974
A. F. Liu Aug. 1974 226 p refs 3 Vol.
(Contract NAS3-16765)
(NASA-CR-134596; SD73-SH-0171-1-Vol-1) Avail: NTIS HC $14.50 CSCL 22B

A systematic approach for applying methods for fracture control in the structural components of space vehicles consists of four major steps. The first step is to define the primary load-carrying structural elements and the type of load, environment, and design stress levels acting upon them. The second step is to identify the potential fracture-critical parts by means of a selection logic flow diagram. The third step is to evaluate the safe-life and fail-safe capabilities of the specified part. The last step in the sequence is to apply the control procedures that will prevent damage to the fracture-critical parts. The fracture control methods discussed include fatigue design and analysis methods, methods for preventing crack-like defects, fracture mechanics analysis methods, and nondestructive evaluation methods. An example problem is presented for evaluation of the safe-crack-growth capability of the space shuttle crew compartment skin structure. Author

N74-35280*# Rockwell International Corp., Downey, Calif. Space Div.
FRACTURE CONTROL METHODS FOR SPACE VEHICLES. VOLUME 2: ASSESSMENT OF FRACTURE MECHANICS TECHNOLOGY FOR SPACE SHUTTLE APPLICATIONS Contractor Report, Jun. 1972 - Mar. 1974
R. M. Ehret Aug. 1974 209 p refs 3 Vol.
(Contract NAS3-16765)
(NASA-CR-134597; SD73-SH-0171-2-Vol-2) Avail: NTIS HC $13.50 CSCL 22B

The concepts explored in a state of the art review of those engineering fracture mechanics considered most applicable to the space shuttle vehicle include fracture toughness, precritical flaw growth, failure mechanisms, inspection methods (including proof test logic), and crack growth predictive analysis techniques. Author

N74-35281*# Rockwell International Corp., Downey, Calif. Space Div.
FRACTURE CONTROL METHODS FOR SPACE VEHICLES. VOLUME 3: SPACE SHUTTLE CONFIGURATIONS Contractor Report, Jun. 1972 - Mar. 1974
A. F. Liu and E. J. Mulcahy Aug. 1974 235 p refs 3 Vol.
(Contract NAS3-16765)
(NASA-CR-134598; SD73-SH-0171-3-Vol-3) Avail: NTIS HC $14.75 CSCL 22B

Engineering drawings are presented which represent the culmination of research efforts towards a space shuttle configuration with adequate fracture control properties. A.A.D.

N74-35282*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DESCRIPTION OF THE METEOROID DETECTION EXPERIMENT FLOWN ON THE PIONEER 10 AND 11 JUPITER FLYBY MISSIONS
Robert L. ONeal, comp. Washington Aug. 1974 120 p refs
(NASA-TN-D-7691; L-9517) Avail: NTIS HC $4.50 CSCL 22C

The meteoroid detection experiment has the objective of measuring the population of 10 to the minus 9th power and 10 to the minus 8th power grams mass particles in interplanetary space with emphasis on making these measurements in the Asteroid Belt. The instrument design, which uses the pressurized-cell-penetration detection technique, and the tests involved in obtaining a flight-qualified instrument are described. The successful demonstration of flight-quality penetration detectors to function properly under long-term simulated space environments is also described. Author

N74-35283*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
DYNAMICS OF A GRAVITY-GRADIENT STABILIZED FLEXIBLE SPACECRAFT Final Report, Mar. 1974
Leonard Meirovitch and Jer-Nan Juang Washington NASA Aug. 1974 100 p refs
(Grant NGR-47-004-098)
(NASA-CR-2456) Avail: NTIS HC $4.00 CSCL 22B

The dynamics of gravity-gradient stabilized flexible satellite in the neighborhood of a deformed equilibrium configuration are discussed. First the equilibrium configuration was determined by solving a set of nonlinear differential equations. Then stability of motion about the deformed equilibrium was tested by means of the Liapunov direct method. The natural frequencies of oscillation of the complete structure were calculated. The analysis is applicable to the RAE/B satellite. Author

N74-35284*# National Aeronautics and Space Administration, Washington, D.C.
SPACE SHUTTLE
Oct. 1974 26 p
(NASA-TM-X-70384; Rept-74-267) Avail: NTIS HC $4.50 CSCL 22B

The space shuttle is discussed as a reusable space vehicle operated as a transportation system for space missions in low earth orbit. Space shuttle studies and operational capabilities are reported for potential missions indicating that about 38 percent are likely to be spacelab missions with the remainder being the replacement, revisit, or retrieval of automated spacecraft. M.C.F.

N74-35285*# Aerospace Corp., El Segundo, Calif. Advanced Vehicle Systems Directorate.
PAYLOAD DESIGN REQUIREMENTS ANALYSIS (STUDY 2.2). VOLUME 1: EXECUTIVE SUMMARY Final Report
T. Shiokari 5 Oct. 1973 33 p refs
(Contract NASw-2472)
(NASA-CR-140589; ATR-74(7332)-1-Vol-1) Avail: NTIS HC $4.75 CSCL 22B

Research was conducted to provide data on ways to effectively realize the projected cost reductions for payloads to be developed and operated in the shuttle era. Prior studies have indicated that the Shuttle concept of satellite operations will lead to a large reduction in overall payload cost. This study provides the data and insight into the methods of accomplishing these economic benefits. The study examined only payloads that will be launched on the shuttle/tug/sortie lab combinations. These payloads are of four types: (1) expendable; (2) ground refurbishable; (3) on-orbit maintainable; and (4) sortie. The expendable payloads are intended specifically for the shuttle/tug and not for expendable launch vehicles. Economic comparisons were made only between these four types of shuttle payloads and not between these payloads and current expendable launch vehicle payloads.
Author

N74-35286*# Aerospace Corp., El Segundo, Calif. Systems Planning Div.
PAYLOAD DESIGN REQUIREMENTS ANALYSIS (STUDY 2.2). VOLUME 3. GUIDELINE ANALYSIS Final Report
T. Shiokari 5 Oct. 1973 469 p refs
(Contract NASw-2472)
(NASA-CR-140585; ATR-74(7332)-1-Vol-3) Avail: NTIS HC $26.50 CSCL 22B

Payloads to be launched on the space shuttle/space tug/sortie lab combinations are discussed. The payloads are of four types: (1) expendable, (2) ground refurbishable, (3) on-orbit maintainable, and (4) sortie. Economic comparisons are limited to the four types of payloads described. Additional system guidelines were developed by analyzing two payloads parameterically and demonstrating the results on an example satellite. In addition to analyzing the selected guidelines, emphasis was placed on providing economic tradeoff data and identifying payload parameters influencing the low cost approaches. Author

N74-35287*# Wyle Labs., Inc., Huntsville, Ala.
DEVELOPMENT OF MODIFIED VIBRATION TEST CRITERIA FOR QUALIFYING SPACE VEHICLE COMPONENTS
K. Y. Chang and G. C. Kao Oct. 1974 67 p refs
(Contract NAS8-30630)
(NASA-CR-120498; WR-74-6) Avail: NTIS HC $6.50 CSCL 22B

Simplified methods are described to estimate the test criteria of primary structures at component attachment points subjected to broadband random acoustic excitations. The current method utilizes a constant smeared component mass attenuation factor across the frequency range of interest. The developed method indicates that the attenuation factor is based on a frequency dependent ratio of the mechanical impedances of both the component and primary structures. The procedures used to predict the structural responses are considered as the present state-of-the-art and provide satisfactory prediction results. Example problems are used to illustrate the application procedures of the two methods and to compare the significant difference. It was found that the lower test criteria obtained by the impedance ratio method is due to the results of considering the effects of component/primary structure interaction. Author

N74-35288*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MATHEMATICAL CREW MOTION DISTURBANCE MODELS FOR SPACECRAFT CONTROL SYSTEM DESIGN M.S. Thesis - George Washington Univ.
Bruce A. Conway Aug. 1974 63 p refs
(NASA-TM-X-70342) Avail: NTIS HC $6.25 CSCL 22B

Several techniques for modeling the disturbances to a spacecraft's attitude caused by moving crew members are presented. These disturbances can be the largest moments acting on a manned spacecraft, and knowledge of their effect is important in the sizing, design, and analysis/simulation of spacecraft attitude control systems. The modeling techniques are identified as two principal types: deterministic and stochastic. Three techniques of each type are presented. The deterministic models include point-mass motion derivatives and a discussion on dynamic models of moving crew members. The stochastic techniques are highlighted by a Fourier transform method and the representation of long-term crew disturbance activities as outputs from appropriately designed filters. A z-transform technique is developed to obtain a difference-equation form of stochastic models for use on digital computers. An appendix derives spacecraft equations of motion which can be used with many of the models discussed. Author

N74-35289*# Aerophysics Research Corp., Hampton, Va.
WAATS: A COMPUTER PROGRAM FOR WEIGHTS ANALYSIS OF ADVANCED TRANSPORTATION SYSTEMS
C. R. Glatt Washington NASA Sep. 1974 128 p refs
(Contract NAS1-12008)
(NASA-CR-2420; LTN-01R2) Avail: NTIS HC $4.75 CSCL 22B

A historical weight estimating technique for advanced transportation systems is presented. The classical approach to weight estimation is discussed and sufficient data is presented to estimate weights for a large spectrum of flight vehicles including horizontal and vertical takeoff aircraft, boosters and reentry vehicles. A computer program, WAATS (Weights Analysis for Advanced Transportation Systems) embracing the techniques discussed has been written and user instructions are presented.

The program was developed for use in the ODIN (Optimal Design Integration System) system. Author

N74-35290*# Aerophysics Research Corp., Hampton, Va.
VAMP: A COMPUTER PROGRAM FOR CALCULATING VOLUME, AREA, AND MASS PROPERTIES OF AEROSPACE VEHICLES
P. J. Norton and C. R. Glatt Washington NASA Sep. 1974 129 p refs
(Contract NAS1-12008)
(NASA-CR-2419; LTN-10) Avail: NTIS HC $4.75 CSCL 22B

A computerized procedure developed for analyzing aerospace vehicles evaluates the properties of elemental surface areas with specified thickness by accumulating and combining them with arbitrarily specified mass elements to form a complete evaluation. Picture-like images of the geometric description are capable of being generated. Author

N74-35291*# Martin Marietta Corp., Denver, Colo.
SS/RCS SURFACE TENSION PROPELLANT ACQUISITION/EXPULSION TANKAGE TECHNOLOGY PROGRAM Interim Report
Aug. 1974 102 p refs
(Contract NAS9-13709)
(NASA-CR-140299; MCR-74-278) Avail: NTIS HC $8.25 CSCL 22B

An evaluation of published propellant physical property data together with bubble point tests of fine-mesh screen in propellants, was conducted. The effort consisted of: (1) the collection and evaluation of pertinent physical property data for hydrazine (N_2H_4), monomethylhydrazine (MMH), and nitrogen tetroxide (N_2O_4); (2) testing to determine the effect of dissolved pressurant gas, temperature, purity, and system cleanliness or contamination on system bubble point, and (3) the compilation and publishing of both the literature and test results. The space shuttle reaction control system (SS/RCS) is a bipropellant system using N_2O_4 and MMH, while the auxiliary power system (SS/APU) employs monopropellant N_2H_4. Since both the RCS and the APU use a surface tension device for propellant acquisition, the propellant properties of interest are those which impact the design and operation of surface tension systems. Information on propellant density, viscosity, surface tension, and contact angle was collected, compiled, and evaluated. Author

N74-35292# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
CONTROL AND STABILIZATION ASPECTS OF AN ADVANCED TELECOMMUNICATION SATELLITE WITH FLEXIBLE SOLAR ARRAYS
A. Pohl, F. Pfeiffer, and R. D. Ebert Paris ESRO May 1973 181 p refs
(Contract ESTEC-1230/71)
(ESRO-CR-90) Avail: NTIS HC $12.25

The analysis of the dynamic behavior of a three-axis stabilized satellite with a flexible roll-out solar array, a rigidly mounted flywheel, and a pendulum nutation damper is refined and extended. Equations of motion are derived using moment of momentum principles, the flexible panel influence being included by a Langrangian approach. An elasticity analysis gives analytical results for the eigenfrequencies and eigenvectors of both the transverse and torsional motions of the panel alone. Simulation results for the transverse vibrations indicate that the flexible panels reduce the effective gyroscopical stiffness of the system, thus causing larger limit cycle roll-yaw angles. In the case of torsional vibrations, the excitation of the panel oscillations by a stepwise panel torque remains small if the stepping torque control is carefully designed. Author (ESRO)

N74-35293# Army Missile Command, Redstone Arsenal, Ala. Guidance and Control Directorate.
USER'S GUIDE FOR A MONTE CARLO POINT TARGET TERMINAL HOMING SIMULATION PROGRAM
D. S. Taylor, A. W. Lee, Jr., and C. L. Lewis 20 May 1974 305 p refs
(DA Proj. 1M3-62303-A-214)
(AD-781992; RG-74-37) Avail: NTIS CSCL 16/2

The report documents a newly developed all-digital, six degree of freedom point target laser guidance Monte - Carlo miss distance simulation program. It is modularly constructed to facilitate adaptation of the program to reflect changing hardware components, different levels of environment modeling detail, etc. The Monte - Carlo approach to statistical miss distance analysis was chosen because a realistic model can be employed (in particular, a linear model is not required) because error coupling is inherently included, and because confidence intervals can be readily calculated. Eight random error sources relating to laser point target guidance are modeled in the program. (Modified author abstract) GRA

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N74-35294+ Shock and Vibration Information Center (Defense), Washington, D.C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 6, NO. 7
Jul. 1974 93 p refs
Avail: NTIS Avail: Director, Navy Publ. and Printing, Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390

Abstracts are presented on current shock and vibration studies. For individual titles, see N74-35295 through N74-35296.

N74-35295 Bolt, Beranek, and Newman, Inc., Canoga Park, Calif. Physical Sciences Dept.
ENERGETICS OF RESONANT STRUCTURES AND REVERBERANT ACOUSTIC FIELDS
L. D. Pope *In* The Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 6, No. 7 Jul. 1974 p 3-13 refs (For availability see N74-35294 24-32)

The response of a single (resonant) mode of a complex structure excited by a reverberant acoustic field is estimated. The result is extended to enable the prediction of the band limited response of a group of resonant modes. In the process, the assumptions of modal statistical independence and of equipartition of modal energies are introduced. The average mechanical and radiation resistances, and the kinetic velocity are defined. Calculation of the radiation resistance is then considered, with reciprocity and the joint acceptance function being the key to the computation. M.C.F.

N74-35296 Southampton Univ. (England). Inst. of Sound and Vibration Research.
STATISTICAL ENERGY ANALYSIS: A CRITICAL REVIEW
F. J. Fahy *In* The Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 6, No. 7 Jul. 1974 p 14-92 refs Presented at the Colloq. of the Comm. Acoust. W51 du Conseil Intern. du Batiment, Liverpool, Oct. 1973 (For availability see N74-35294 24-32)

The response of mechanical structures and fluids to force fields which are random in time and space, and which are represented by various probabilistic models are discussed applying statistical analysis. Statistical energy analysis has so far been used mainly in the analysis of vibration by stationary random forces; however, some progress has been made in the analysis of power flow between coupled oscillators excited by nonstationary forces. M.C.F.

N74-35297+ Engineering Sciences Data Unit, London (England).
EXAMPLES ON THE USE OF DATA ITEMS ON FATIGUE CRACK PROPAGATION RATES
Sep. 1974 14 p ref Sponsored by Roy. Aeron. Soc.
(ESDU-74017) Copyright. Avail: NTIS HC $36.00

The behavior of damage tolerant structures such as aircraft fuselage and wing panels are discussed to explain, compare and illustrate by means of worked examples, applications of fatigue crack propagation rate data. Examples of crack propagation calculations are provided along with appropriate materials data and stress intensity factor solutions. M.C.F.

N74-35298 Virginia Polytechnic Inst. and State Univ., Blacksburg.
A TECHNIQUE FOR THE DETERMINATION OF THE MODE 1 STRESS INTENSITY FACTOR FROM PHOTOELASTIC DATA WITH APPLICATIONS TO THREE DIMENSIONAL CRACK PROBLEMS Ph.D. Thesis
Michael Andrew Schroedl 1974 138 p
Avail: Univ. Microfilms Order No. 74-20374

A technique is presented for the determination of the mode i stress intensity factor for three dimensional crack problems. A Taylor series correction to the singular form of the maximum inplane shear stress in a plane perpendicular to the crack border was used in conjunction with the photoelastic freezing and slicing technique to obtain least squares estimates of the stress intensity factor. The order one correction is shown to correspond physically to the stress parallel to the crack at the crack tip. This correction is shown to be significant and to grow strongly as the crack approaches a free boundary. The validity of using various blunt notches to simulate the line crack is established analytically. The validity of various approximate solutions to the problem of a semielliptical surface flaw under cylindrical bending is evaluated and three dimensional effects on the compact tension fracture toughness specimen are studied. Dissert. Abstr.

N74-35299 Vanderbilt Univ., Nashville, Tenn.
A MODEL OF COUPLE STRESS EFFECT UPON THE TRANSVERSE STIFFNESS OF A FIBER-REINFORCED MATERIAL Ph.D. Thesis
Surinder Kumar Lakhanpal 1974 94 p
Avail: Univ. Microfilms Order No. 74-22179

The possible effect of couple stresses on the transverse elastic moduli of anisotropic composite material systems is discussed. Couple stress theory considers that within an elastic body, the surface of each element of materials is subjected not only to normal and tangential stress components but also to a moment component designated as a couple stress, thus introducing another elastic constant of the material. The necessary theory of elasticity needed for this purpose is developed and extended from the available classical theory found in the literature. The model considered is a uniaxially loaded infinitely long rectangular cell of composite material with a circular fiber located at the center. The stress and displacement fields thus developed in the composite cell are for the plane strain case. A numerical solution for the transverse elastic stiffness of the composite material as a function of the elastic constants, including the moduli of curvature, of the fiber and the matrix is developed. The results thus obtained are compared with those of classical theory. Dissert. Abstr.

N74-35300*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Applied Mechanics Div.
A SHOCK SPECTRA AND IMPEDANCE METHOD TO DETERMINE A BOUND FOR SPACECRAFT STRUCTURAL LOADS
R. Bamford and M. Trubert 1 Sep. 1974 42 p refs
(Contract NAS7-100)
(NASA-CR-140177; JPL-TM-33-694) Avail: NTIS HC $5.25 CSCL 20K

A method to determine a bound of structural loads for a spacecraft mounted on a launch vehicle is developed. The method utilizes the interface shock spectra and the relative impedance of the spacecraft and launch vehicle. The method is developed for single-degree-of-freedom models and then generalized to multidegree-of-freedom models. Author

N74-35301# Oak Ridge National Lab., Tenn. Computer Sciences Div.
USERS MANUAL FOR ORNL CREEP-PLAST GRAPHICS PACKAGE
P. G. Fowler, J. S. Crowell, and J. A. Clinard Sep. 1974 49 p
(Contract W-7405-eng-26)
(ORNL-TM-4642) Avail: NTIS HC $5.50

User information for the CRNL version of CREEP-PLAST is provided. Complete input instructions are included and sample input and output are given. Author

N74-35302# National Aerospace Lab., Tokyo (Japan).
BENDING MOMENTS AND VIBRATION CAUSED BY WIND ON LAUNCH VEHICLES
Hidehiko Mori 1974 30 p refs In JAPANESE; ENGLISH summary
(NAL-TR-355) Avail: NTIS HC $4.50

This research is an extension of the system study to construct a model launch vehicle for geostationary satellite, and attempts to present the wind effects on the launch vehicle, especially focusing on bending moment and lateral vibration. Bending moment coefficients are calculated for angle of attack, engine deflection and generalized coordinates of bending. Angle of attack and engine deflection are mainly associated with the quasi-steady-state wind, and their approximate values are given by rigid body trajectory simulation. Turbulence effects on the variances of generalized coordinates of bending and other variables are evaluated by stochastic methods. In this evaluation various degrees of approximation for equations of motion are taken to assess the influence of model refinements. These computations provide insights to the interaction between vehicle characteristics and two types of winds. The present model vehicle SS-3 has proved to be little affected by the turbulence and have a firm structure. Author

N74-35303*# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
TRADEOFFS IN MANIPULATOR STRUCTURE AND CONTROL. PART 4: FLEXIBLE MANIPULATOR ANALYSIS PROGRAM Final Report
Wayne J. Book 31 Aug. 1974 91 p
(Contract NAS8-28055)
(NASA-CR-120495) Avail: NTIS HC $7.75 CSCL 20K

The Flexible Manipulator Analysis Program (FMAP) is a collection of FORTRAN coding to allow easy analysis of the flexible dynamics of mechanical arms. The user specifies the arm configuration and parameters and any or all of several frequency domain analyses to be performed, while the time domain impulse response is obtained by inverse Fourier transformation of the frequency response. A detailed explanation of how to use FMAP is provided. Author

N74-35304*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN ELASTOPLASTIC ANALYSIS OF A UNIAXIALLY LOADED SHEET WITH AN INTERFERENCE-FIT BOLT
John H. Crews, Jr. Washington Oct. 1974 25 p refs
(NASA-TN-D-7748; L-9593) Avail: NTIS HC $3.00 CSCL 20K

The stresses and strains in a uniaxially loaded sheet with an unloaded interference-fit bolt were calculated by an elastoplastic finite-element analysis. The material properties represented a 7075-T6 aluminum alloy sheet and a steel bolt. The analysis considered the two ideal cases of no slip and no friction at the bolt-sheet interface for a single combination of bolt diameter, interference level, and cyclic loading. When the bolt was inserted, the sheet deformed plastically near the hole; the first tensile load cycle produced additional yielding, but subsequent cycles to the same level caused only elastic cyclic stresses. These stresses together with fatigue data for unnotched specimens were used to estimate crack initiation periods and initiation sites. The cases analyzed with interference-fit bolts were predicted to have crack initiation periods which were about 50 times that for a clearance-fit bolt. Crack initiation was predicted to occur on the transverse axis at a distance of about one radius from the hole. Author

N74-35305*# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
MODAL ANALYSIS AND CONTROL OF FLEXIBLE MANIPULATOR ARMS Ph.D. Thesis
Octavio Maizza Neto 10 Sep. 1974 223 p refs
(Contract NAS8-28055)
(NASA-CR-120494) Avail: NTIS HC $14.25 CSCL 20K

The possibility of modeling and controlling flexible manipulator arms was examined. A modal approach was used for obtaining the mathematical model and control techniques. The arm model was represented mathematically by a state space description defined in terms of joint angles and mode amplitudes obtained from truncation on the distributed systems, and included the

motion of a two link two joint arm. Three basic techniques were used for controlling the system: pole allocation with gains obtained from the rigid system with interjoint feedbacks, Simon-Mitter algorithm for pole allocation, and sensitivity analysis with respect to parameter variations. An improvement in arm bandwidth was obtained. Optimization of some geometric parameters was undertaken to maximize bandwidth for various payload sizes and programmed tasks. The controlled system is examined under constant gains and using the nonlinear model for simulations following a time varying state trajectory.
Dissert. Abstr.

N74-35306*# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
TRADEOFFS IN MANIPULATOR STRUCTURE AND CONTROL. PART 1: SUMMARY Final Report
Daniel E. Whitney, Wayne J. Book, and Octavio Maizza-Neto 31 Aug. 1974 4 p refs
(Contract NAS8-28055)
(NASA-CR-120493) Avail: NTIS HC $4.00 CSCL 20K

The study of various aspects of manipulator design and control is summarized, focusing on the interaction of the structure's flexible dynamics and the dynamics of the joint control system, including specific information on modeling and design, modal analysis and control, and the flexible manipulator analysis computer program, FMAP.
Author

N74-35307*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A METHOD FOR DETERMINING LOCAL ELASTOPLASTIC STRESS AND STRAIN IN METALLURGICALLY BONDED NOTCHED LAMINATES SUBJECTED TO A LOADING CYCLE
J. A. Sova and John H. Crews, Jr. Washington Oct. 1974 23 p refs
(NASA-TN-D-7766; L-9753) Avail: NTIS HC $3.00 CSCL 20K

A semianalytical method was developed for determining elastoplastic cyclic stresses and strains at notch roots in metallurgically bonded metal laminates. The method is based on the Neuber equation, which was used with an effective stress-strain curve for the laminate. It was applied to laminates containing a circular hole which were subjected to one cycle of reversed loading. The laminates consisted of two elasto-perfectly-plastic materials with different yield strengths and with either equal or different Young's moduli. A laminate of high-strength titanium alloy with alternate layers of commercially pure titanium was also analyzed. The accuracy of the method was evaluated by comparing the stresses and strains with those calculated from a finite-element analysis. The results estimated by the simple method based on the Neuber equation agreed closely with the results computed from the more elaborate finite-element analysis.
Author

N74-35308*# Lehigh Univ., Bethlehem, Pa.
CRACK OPENING STRETCH IN A PLATE OF FINITE WIDTH
F. Erdogan and M. Bakioglu Sep. 1974 21 p refs
(Grants NGR-39-007-001; NSF GK-42771x)
(NASA-CR-140583) Avail: NTIS HC $4.25 CSCL 20K

The problem of a uniaxially stressed plate of finite width containing a centrally located damage zone is considered. It is assumed that the flaw may be represented by a part-through crack perpendicular to the plate surface, the net ligaments in the plane of the crack and through-the-thickness narrow strips ahead of the crack ends are fully yielded, and in the yielded sections the material may carry only a constant normal traction with magnitude equal to the yield strength. The problem is solved by neglecting the bending effects and the crack opening stretches at the center and the ends of the crack are obtained. Some applications of the results are indicated by using the concepts of critical crack opening stretch and constant slope plastic instability.
Author

N74-35309*# Lehigh Univ., Bethlehem, Pa.
FRACTURE AND CONTACT PROBLEMS FOR AN ELASTIC WEDGE
F. Erdogan and K. Arin May 1974 21 p refs
(Grants NGR-39-007-011; NSF GK-42771x)
(NASA-CR-140582) Avail: NTIS HC $4.25 CSCL 20K

The plane elastostatic contact problem for an infinite elastic wedge of arbitrary angle is discussed. The medium is loaded through a frictionless rigid wedge of a given symmetric profile. Using the Mellin transform formulation the mixed boundary value problem is reduced to a singular integral equation with the contact stress as the unknown function. With the application of the results to the fracture of the medium in mind, the main emphasis in the study has been on the investigation of the singular nature of the stress state around the apex of the wedge and on the determination of the contact pressure.
Author

N74-35310# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PARAMETRICALLY EXCITABLE OSCILLATIONS OF A CYLINDRICAL SHELL, FILLED WITH COMPRESSIBLE LIQUID OR GAS
M. A. Ilgamov and Zh. M. Sakhabutdinov 25 Jun. 1974 16 p refs Transl. into ENGLISH from the book "Teoriya Plastin i Obolochek" Kazin, 1971 p 123-129
(AD-782545; FTD-MT-24-1105-74) Avail: NTIS CSCL 20/11

In this work there is examined the behavior of a system, consisting of isotropic round cylindrical shell of constant thickness h with radius R, filled with compressible liquid or gas. One end of tbe shell is enclosed by a rigid bottom, on the other - a flat piston oscillates with prescribed frequency and amplitude. The restrained edges of the shell can be freely displaced, the forces from the bottom are not transferred to the shell.
GRA

N74-35311# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
BENDING OF A THREE LAYER CYLINDRICAL SHELL REINFORCED WITH A REGULAR SYSTEM OF RECTANGULAR STIFFENERS
L. F. Vodyanoi 24 Jun. 1974 9 p refs Transl. into ENGLISH from Soprotivlenie Materialov i Teorii Sooruzhenii (USSR), no. 16, 1972 p 33-36
(AD-782535; FTD-HT-23-1508-74) Avail: NTIS CSCL 20/11

This article investigates the bending of a three-layer shallow shell under the effect of a transverse load. The shell is of symmetric construction in terms of thickness with isotropic bearing layers of thickness t and a light isotropic transversal filler of thickness 2h. The broken line hypothesis is used for the tangential displacements of the shell. Flexural rigidity of the external layers is not considered.
GRA

N74-35312# Naval Ship Research and Development Center, Bethesda, Md.
DEFINIT: A NEW ELEMENT DEFINITION CAPABILITY FOR NASTRAN USER'S MANUAL
Michael E. Golden and Myles M. Hurwitz Dec. 1973 202 p refs
(ZR10402)
(AD-782513; NSRDC-4250) Avail: NTIS CSCL 09/2

To relieve the user's of NASTRAN--the National Aeronautics and Space Administration's general purpose finite element, structural analysis computer program--from the necessity of becoming involved with internal aspects of NASTRAN when he adds a new element, a new element definition capability has been developed. This capability takes the form of a preprocessor which will generate, according to user specifications, the FORTRAN routines and tables required by NASTRAN for a new element. The manual contains details and instructions on the use of the preprocessor, and provides numerous examples.
Author (GRA)

N74-35313# Ballistic Research Labs., Aberdeen Proving Ground, Md.
FIBER-MATRIX DISPLACEMENT DURING THE COMPRESSIVE PHASE OF SHOCK LOADING
George E. Hauver May 1974 42 p refs
(DA Proj. 1T0-61102-B-33A)
(AD-781957; BRL-MR-2383) Avail: NTIS CSCL 11/4

Electromagnetic-gage type measurements were performed to determine fiber (wire)-matrix displacement during the compressive phase of shock loading. Fiber diameter and shock impedance were the variables investigated. The relative displacement was

found to increase with the fiber diameter, but data for each fiber material could be well represented by a single curve if fiber diameter was used as the unit of relative displacement and shock transit time through the fiber diameter was used as the unit of time. Fibers attained the matrix velocity after a maximum, (normalized relative) displacement which varied linearly as the three-halves power of the shock impedance.
Author (GRA)

N74-35314# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE PROPAGATION OF SLIGHT DISTURBANCES IN AN ELASTIC CYLINDRICAL SHELL, WHICH CONTAINS LIQUID
E. B. Ometsinskaya and M. E. Babeshko 26 Jun. 1974 13 p refs Transl. into ENGLISH from the monograph "Teoriya Plastin i Obolochek" Kazin, 1971 p 2
(AD-782539; FTD-MT-24-1107-24) Avail: NTIS CSCL 20/11
The dispersion relationships which describe the propagation of harmonic waves of displacement in liquid-filled cylindrical shells were investigated, along with the effects of refined boundary conditions on the wettable surface of the shell. The hydroelastic problem is solved by joint application of the equations which separately define the motion of the liquid and the dynamics of the elastic shell. A.A.D.

N74-35315# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE STABILITY AND LARGE DEFLECTIONS OF AN ORTHOTROPIC LONG CYLINDICAL PANEL UNDER THE ACTION OF UNIFORM EXTERNAL PRESSURE
M. S. Kornishin and M. S. Ganeeva 26 Jun. 1974 14 p refs Transl. into ENGLISH from the book "Teoriya Plastin i Oboloched" Kazan, 1971 p 161-166
(AD-782554; FTD-MT-24-1106-74) Avail: NTIS CSCL 20/11
Solutions to the problem of stability and large deflections of a mildly sloping orthotropic cylindrical panel without allowing for and taking into account deformations of transverse shear under critical loads are compared. Data cover type of boundary conditions, amount of load, and geometric parameters of the panel. Author

N74-35316# New York Univ., N.Y. Courant Inst. of Mathematical Sciences.
CONSTRUCTION OF A THREE DIMENSIONAL DISPLACEMENT FIELD FROM A SOLUTION TO THE VON KARMAN EQUATIONS
Chester B. Sensening Jun. 1974 25 p refs
(Contract N00014-67-A-0467-0030; NR Proj. 041-446)
(AD-781917; IMM-403) Avail: NTIS CSCL 20/11
In the report the author defines a three dimensional displacement field in terms of a solution to the von Karman equations and determines how well the three dimensional displacement field satisfies the exact theory of elasticity for a plate with zero body force and zero stress vector at the faces. (Modified author abstract) GRA

N74-35317# Illinois Univ., Urbana. Dept. of Aeronautical and Astronautical Engineering.
FINITE ELEMENT COMPUTER PROGRAM FOR THE ANALYSIS OF LAYERED, ORTHOTROPIC STRUCTURES Contract Report, 11 Jan. 1973 - 31 Jan. 1974
A. R. Zak Jun. 1974 94 p refs
(Contract DAAD05-73-C-0197; DA Proj. 1M5-62603-A-286)
(AD-783412; BRL-CR-158) Avail: NTiS CSCL 20/11
A finite element method is developed for the structural analysis of layered, orthotropic materials. The method is based on second order elements in which the displacement variation through each element is assumed to be quadratic with respect to the coordinates. This variation permits the use of elements with curved boundaries. The analysis applies to axially symmetric geometries and loads but the axes of orthotropy are not restricted to the plane of symmetry and consequently, three dimensional displacements can be analyzed. The program allows application of four different loading conditions which consist of surface, concentrated, thermal and inertia loads. Numerical example is presented to illustrate the accuracy of the method and the computer program. Author (GRA)

N74-35318# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE STABILITY OF CYLINDRICAL SHELLS UNDER THE ACTION OF DYNAMIC RADIAL PRESSURE
M. A. Shumik 25 Jun. 1974 13 p refs Transl. into ENGLISH from proceedings of 7th Vsesoyuznoi Konferentsii po Teorii Obolochek i Plastinok (Moscow), 1970 p 625-628
(AD-782889; FTD-HT-23-1504-74) Avail: NTIS CSCL 20/11
A study was made of the relationship of critical dynamic pressure to the geometric and mechanical parameters of a smooth shell and the law of loading. Data show that with intensive loading the critical pressure impulse does not depend on the law of loading and will be a constant value for the given shell. Investigations were also made of the effect of rib arrangement, relative to the middle surface of the shell, on the amount of critical pressure. Author (GRA)

N74-34496* United Aircraft Corp., Stratford, Conn.
CORRELATION OF FINITE-ELEMENT STRUCTURAL DYNAMIC ANALYSIS WITH MEASURED FREE VIBRATION CHARACTERISTICS FOR A FULL-SCALE HELICOPTER FUSELAGE
Irwin J. Kenigsberg, Michael W. Dean, and Ray Malatino (Naval Air Systems Command) *In* NASA. Ames Res. Center Rotorcraft Dyn. 1974 p 67-80 refs (For availability see N74-34489 24-02)
CSCL 20K

N74-34499* Kaman Aerospace Corp., Bloomfield, Conn.
APPLICATION OF ANTIRESONANCE THEORY TO HELICOPTERS
Felton D. Bartlett, Jr. and William G. Flannelly *In* NASA. Ames Res. Center Rotorcraft Dyn. 1974 p 101-106 refs (For availability see N74-34489 24-02)
CSCL 20K

N74-34513* Kaman Aircraft Corp., Bloomfield, Conn.
IDENTIFICATION OF STRUCTURAL PARAMETERS FROM HELICOPTER DYNAMIC TEST DATA
Nicholas Giansante and William G. Flannelly *In* NASA. Ames Res. Center Rotorcraft Dyn. 1974 p 239-248 refs (For availability see N74-34489 24-02)
CSCL 20K

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N74-35319 Colorado Univ., Boulder.
A DISCRETE LEAST SQUARES FINITE ELEMENT METHOD FOR TRANSIENT HEAT CONDUCTION PROBLEMS Ph.D. Thesis
Gauranga Sundar Chakrabarti 1974 440 p
Avail: Univ. Microfilms Order No. 74-22328
A theoretical formulation is presented along with adaptations for several newly developed marching schemes based on collocation and subdomain considerations in the time-domain. Rectangular and quadrilateral elements specifically suitable for heat conduction problems have been developed. The numbers of degrees of freedom for the elements developed have been reduced by employing some special criteria. Although both the elements have proven to be quite effective, the quadrilateral element is preferred because of its flexibility in representing irregular boundaries. Numerical investigations have been performed on one- and two-dimensional problems with known solutions using these elements and employing various marching schemes developed. Numerical results are found to be in good agreement with exact solutions. Computer programs have also been developed to carry out numerical investigation of this technique by various marching schemes. Dissert. Abstr.

N74-35320*# Aeronautical Research Associates of Princeton, Inc., N.J.

DEVELOPMENT OF A SECOND ORDER CLOSURE MODEL FOR COMPUTATION OF TURBULENT DIFFUSION FLAMES

Ashok K. Varma and Coleman duP. Donaldson Jun. 1974 27 p refs

(Contract NAS1-12412)

(NASA-CR-132524; ARAP-222) Avail: NTIS HC $3.25 CSCL 20M

A typical eddy box model for the second-order closure of turbulent, multispecies, reacting flows developed. The model structure was quite general and was valid for an arbitrary number of species. For the case of a reaction involving three species, the nine model parameters were determined from equations for nine independent first- and second-order correlations. The model enabled calculation of any higher-order correlation involving mass fractions, temperatures, and reaction rates in terms of first- and second-order correlations. Model predictions for the reaction rate were in very good agreement with exact solutions of the reaction rate equations for a number of assumed flow distributions.

Author

N74-35321# National Research Council of Canada, Ottawa (Ontario).

LAMINAR FLAME PROPAGATION IN LIQUID FUEL DROPLET SUSPENSIONS

M. Ogasawara and Y. Mizutani 1974 73 p refs Transl. into ENGLISH from Nippon Kikai Gakkai Ronbunshu (Tokyo), v. 31, no. 226, 1965 p 1002-1026

(NRC-TT-1757) Avail: NTIS HC $6.75

The process is studied wherein a laminar flame propagates in a group of liquid tetralin fuel droplets having uniform diameters, as a first step toward elucidating the phenomenon of flame propagation in a liquid fuel spray. The following facts are reported: (1) as the droplet diameters increase, the lean inflammable limit concentration shifts markedly to the lean side. Thus, combustion is possible even with very disperse mixtures in the neighbourhood of from 100 to 170 micron; (2) in the range of droplet diameters form 100 to 170 micron, each droplet diffuses and combusts independently, and there occurs a noncontinuous flame propagation wherein the flame propagates from droplet to droplet; like stepping stones; (3) the combusting droplets receive a considerably large acceleration from the thermal expansion of the gas; and (4) the falling of the droplets because gravity has a great effect on the process of flame propagation. Author

N74-35322# National Aerospace Lab., Tokyo (Japan).

INTERACTION OF A SHOCK WAVE WITH A BURNING DROP

J. A. Nicholls (Michigan Univ.) and Hiroshi Miyajima May 1974 15 p refs

(NAL-TR-362T) Avail: NTIS HC $4.00

A technique was developed for dropping and igniting a single fuel drop in the test section of a shock tube. Shock waves of various strength were generated and passed over burning and non-burning drops. Photographic results were interpreted to give information on wake stabilization of the flame, flame blow-off, drop distortion and break-up, and drag coefficient. Author

N74-35323*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.

DESIGN FABRICATION, TESTING, AND DELIVERY OF SHUTTLE HEAT PIPE LEADING EDGE TEST MODULES. VOLUME 1: EXECUTIVE SUMMARY Final Report

20 Apr. 1973 24 p refs

(Contract NAS8-28656)

(NASA-CR-124425; MDC-E0775-Vol-1) Avail: NTIS HC $4.25 CSCL 20M

The construction of two test modules is presented for a feasibility demonstration of a concept for reusable space shuttle wing leading edge surfaces. In this leading edge concept high temperature heat pipes were incorporated into the structure to cool the stagnation region, allowing the use of super-alloys in place of refractory metal, ablator protected, or carbon-carbon structures. The program included the analysis and design of the heat pipes, their integration into the test module structure, heat pipe development testing, construction of the test modules and a facility adapter, and formulation of recommended testing conditions. The results of the heat pipe and leading edge module thermal analyses indicate the test modules will meet the design goal; reducing the leading edge temperature at the stagnation line from 1315 C (2400 F) to less than 1010 C (1850 F). The development tests demonstrated that the module assembly could be brazed with active heat pipes, as was borne out by the subsequent successful brazing of both modules with active heat pipes loaded with sodium. Author

N74-35324*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

EFFECT OF PRIMARY-ZONE EQUIVALENCE RATIO AND HYDROGEN ADDITION ON EXHAUST EMISSION IN A HYDROCARBON-FUELED COMBUSTOR

Carl T. Norgren and Robert D. Ingebo Washington Oct. 1974 19 p refs

(NASA-TM-X-3117; E-8011) Avail: NTIS HC $3.00 CSCL 20M

The effects of reducing the primary-zone equivalence ratio on the exhaust emission levels of oxides of nitrogen, carbon monoxide, and unburned hydrocarbons in experimental hydrocarbon-fueled combustor segments at simulated supersonic cruise and idle conditions were investigated. In addition, the effects of the injection of hydrogen fuel (up to 4 percent of the total weight of fuel) on the stability of the hydrocarbon flame and exhaust emissions were studied and compared with results obtained without hydrogen addition. Author

N74-35325# Central Electricity Generating Board, Berkeley (England). Berkeley Nuclear Labs.

THE VAPOUR PHASE COMBUSTION OF SODIUM

R. N. Newman Apr. 1974 23 p refs

(RD/B/N-2965) Avail: NTIS HC $4.25

A laminar sodium vapor-air diffusion flame was used to study the vapor phase burning of sodium at atmospheric pressure. Spectral recordings in the visible region indicate that the condensed oxide is produced from the gas phase reactions in times of 0.0001 seconds. Sodium D lines are detected in emissions above the continuum in the flame which show secondary maxima indicative of chemiluminescent reactions. The existence of the gas phase peroxide molecule Na_2O_2 is postulated. From a thermochemical/kinetic analysis of possible flame mechanisms it is postulated that the smoke is formed initially by the reactions: $Na + O_2 + X$ yields $NaO_2 + X$; $NaO_2 + Na + X$ yields $Na_2O_2 + X$, Na_2O_2 yields $Na_2O_2(c)$. Author

N74-35326*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

A CASCADE INVESTIGATION OF A CONVECTION- AND FILM-COOLED TURBINE VANE MADE FROM RADIALLY STACKED LAMINATES

Herbert J. Gladden Washington Oct. 1974 25 p refs

(NASA-TM-X-3122; E-8002) Avail: NTIS HC $3.00 CSCL 21E

Heat-transfer was investigated on an air-cooled turbine vane made from photoetched laminates that were joined by diffusion bonding. Data from the investigation were compared with data of an impingement-, convection-, and film-cooled vane and a full-coverage film-cooled vane, and data of a transpiration-cooled vane. Author

N74-35327# Rocket Propulsion Establishment, Westcott (England).

POOL BURNING: A REVIEW

A. R. Hall Dec. 1972 87 p refs

(RPE-TR-72/11; BR40240) Avail: NTIS HC $7.50

Fundamental aspects of the combustion of liquid fuel at a free surface are reviewed. These include: (1) influence of atmospheric conditions, fuel properties, diameter of container, partial venting of container on the burning characteristics, and particularly the burning rate; (2) temperature distribution in the liquid, the phenomena of hot zone formation, and boil-over; (3) prevailing concepts of heat transfer from the flame to the liquid; and (4) effect of water as a dispersed phase, and as a substrate, on burning. Author (ESRO)

N74-35328# Ballistic Research Labs., Aberdeen Proving Ground, Md.
FLAMMABILITY LIMITS OVER LIQUID SURFACES
James T. Dehn May 1974 68 p refs
(AD-781958; BRL-1719) Avail: NTIS CSCL 21/4

A test is described for determining the flammable limits of liquid fuels and for rating the relative effectiveness of soluble inerting agents. This layered cup test resembles the widely used tube flame-propagation test in certain respects and differs from it in others. It requires simple equipment and is especially suited to liquid fuels which are more difficult to handle in the tube flame-propagation experiment than gases. It brings out explicitly the role played by relative volatilities in the case of inerting agents in flammable liquids. Comparisons with tube flame-propagation results and the results of standard flash point methods are made. Possible mechanisms are also discussed.
Author (GRA)

N74-35329# Army Foreign Science and Technology Center, Charlottesville, Va.
OPTICAL AND ELECTRON MICROSCOPE STUDIES OF THE CATALYSIS OF COMBUSTION OF AMMONIUM PERCHLORATE
O. P. Korabeinichev, I. A. Ryzhak, and P. N. Kuznetsov 8 Aug. 1973 5 p refs Transl. into ENGLISH from Fiz. Goreniya Vzryva (USSR), v. 8, 1972 p 323-324
(AD-781933; FSTC-HT-23-1772-73) Avail: NTIS CSCL 21/2

The present work presents the results of microscopic and electron microscope studies of the structure and dispersion of the catalysts Fe2O3 and CuO in specimens of ammonium perchlorate and on the combustion surface of extinguished specimens.
GRA

N74-35330# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MIXING ZONE STRUCTURE AND PECULIARITIES OF GAS BURN-UP BEYOND THE FLAME STABILIZER
L. S. Butovskii and V. A. Khristich 17 Apr. 1974 12 p refs Transl. into ENGLISH from Teor. Prakt. Sziganiya Gaza (USSR), v. 5, 1972 p 76-82
(AD-778532; FTD-HT-23-874-74) Avail: NTIS CSCL 21/2

The application of bluff body stabilizers to burning ready fuel mixtures and diffusion burning of gas fuel when the fuel is fed directly into the re-circulation zone beyond the stabilizer, is reported. Data also cover the role played by the stabilizer in the mixing process. Results show that the gas supply system has a relatively slight effect on the picture concentration fields, and, consequently, their nature is associated basically with the aerodynamic pecularities of the flow beyond the stabilizer.
E.H.W.

N74-35331# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
BURNING OF CONDENSED ALUMINIZED SYSTEMS UNDER OVERLOAD
S. K. Ordzhonikidze, A. D. Margolin, P. F. Pokhil, and A. S. Uralov 28 Jun. 1974 20 p refs Transl. into ENGLISH from Fiz. Goreniya Vzryva (USSR), v. 7, no. 4, Dec. 1971 p 536-544
(AD-783574; FTD-HT-23-1219-74) Avail: NTIS CSCL 21/2

In a number of cases inertial forces applied to a burning substance significantly increase the burning rate. In the present study the burning of aluminized systems is studied experimentally and theoretically. Measured were the combustion rate, mass, and composition of slags forming in a condensed system consisting of 70% ammonium perchlorate, 15% rubber, and 15% aluminum powder with a particle dimension size of about 10 micrometers. For the purpose of creating the overloads the specimen was attached radially to a disc (radius 4.5 cm), which together with the electrical motor which rotated it was placed in a vessel with a volume of 2 which was filled with nitrogen when the disc reached a constant rate of rotation, an electrical igniter was used to ignite the specimen.
GRA

N74-35157 Westinghouse Electric Corp., Pittsburgh, Pa.
HEAT TRANSFER AND ENERGY CONVERSION SYSTEMS
P. W. Davison and K. C. Sokolosky (New England Elec. System) *In* Princeton Univ. A Fusion Power Plant Aug. 1974 p 217-290 refs (For availability see N74-35146 24-25)

34 GENERAL

Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N74-35332* + National Aeronautics and Space Administration, Washington, D.C.
SIGNIFICANT NASA INVENTIONS: AVAILABLE FOR LICENSING IN FOREIGN COUNTRIES
1974 81 p refs
(NASA-SP-7038(02)) Avail: NTIS Avail: SOD HC $0.19 CSCL 13I

Abstracts of NASA-owned inventions, which have been made available for patent licensing in foreign countries are presented.
F.O.S.

N74-35333# Committee on Government Operations (U. S. Senate).
CURRENT ENERGY SHORTAGES OVERSIGHT SERIES (THE MAJOR OIL COMPANIES), PART 2
Washington GPO 1974 166 p ref Hearings pursuant to Section 4, S. Res. 46 before Subcomm. on Investigations of Comm. on Govt. Operations, 93d Congr., 2d Sess., 21 Jan. 1974
(GPO-28-575-PT-2) Avail: SOD HC $1.50

The role of the domestic oil industry in dealing with the energy crisis was questioned in a Congressional hearing convened to gather information on the effects of oil import quotas, as well as to hear reliable data concerning charges that major oil companies have intended to eliminate price competition, and are hoarding production, to force both the adoption of new tax subsidies and the revocation of environmental laws. The positions of the major oil interests are represented both by direct testimony, and by response to a questionnaire designed to reflect projected and actual supply/demand balances and crude oil imports for the period 1971 through 1974.
A.A.D.

N74-35334# Committee on Interior and Insular Affairs (U. S. Senate).
FUEL SHORTAGES, PART 3
Washington NASA 1974 104 p Hearing pursuant to S. Res. 45 a national fuels and energy policy study before Comm. on Interior and Insular Affairs, 93d Congr., 1st Sess., 25 May 1973
(GPO-23-158) Avail: Comm. on Interior and Insular Affairs

The impacts of the energy crisis on private commerce were assessed by congressmen, union officials, farmers, and small businessmen from the Midwest in a hearing before Congress which attempted to measure the real consequences of current trends in energy supply.
A.A.D.

N74-35335# Committee on Interior and Insular Affairs (U. S. Senate).
ENERGY INFORMATION ACT. PART 3: APPENDIX
Washington GPO 1974 453 p refs Hearings on S. 2782 before Comm. on Interior and Insular Affairs, 93d Congr., 2d Sess., 15 Feb. 1974
(GPO-29-910) Avail: Comm. on Interior and Insular Affairs

Data were submitted to Congress which are relevant to a proposed bill for the establishment of a national energy information system, and for the authorization of the Department of the Interior to undertake an inventory of U.S. energy resources on public lands. The results of a national gas reserves study are provided, and a computerized decision making system designed to integrate social, economic, and environmental processes is proposed. A similar energy-based information classification system is also discussed.
A.A.D.

N74-35336# Committee on Government Operations (U. S. Senate).
CURRENT ENERGY SHORTAGES OVERSIGHT SERIES (THE MAJOR OIL COMPANIES), PART 4
Washington GPO 1974 145 p Hearings pursuant to Section 4, S. Res. 46 before Subcomm. on Investigations of

Comm. on Govt. Operations, 93d Congr., 2d Sess., 23 Jan. 1974
(GPO-28-575-PT-4) Avail: SOD HC $1.40

Summaries of negotiations between major U.S. oil companies and Middle Eastern governments during the period from 1964 to 1974 were presented in a hearing before Congress which attempted to identify possible irregular procedures in foreign trade which may have contributed to the current energy crisis. The oil companies also submitted complete accounts of their inventories during the embargo period, and provided estimates of recoverable U.S. crude oil and natural gas reserves for 1973 and 1974. A.A.D.

N74-35337# Committee on Government Operations (U. S. Senate).
CURRENT ENERGY SHORTAGES OVERSIGHT SERIES (THE FEDERAL ENERGY OFFICE), PART 5
Washington GPO 1974 96 p Hearings pursuant to Section 4, S. Res. 46 before Subcomm. on Investigations of Comm. on Govt. Operations, 93d Congr., 1st Sess., 25 Jan. 1974
(GPO-29-547) Avail: SOD HC $1.00

The activities reported to Congress by the Federal Energy Office (FEO) include: (1) the formulation of a fivefold approach to energy policy; (2) the gathering of energy data from current information sources; (3) the development of computer based national energy information systems with comprehensive reporting systems; (4) public disclosure of up to date indicators of energy supply outlook and suggestions for conservation; and (5) the sponsorship of energy-related legislation. The interaction of the FEO with major oil companies, state agencies, and other Federal departments is discussed with specific examples. A.A.D.

N74-35338# RAND Corp., Santa Monica, Calif.
GUIDING URBAN GROWTH: POLICY ISSUES AND DEMOGRAPHIC CONSTRAINTS
Peter A. Morrison May 1974 18 p refs
(P-5212) Avail: NTIS HC $4.00

Five aspects of the migration process related to demographic change and constraints are considered: (1) the concentration of migratory growth in only a few metropolitan areas; (2) migration's apparently one-sided economic wisdom, arising out of the weakness of economic push; (3) the potential for return migration, which derives from latent migratory predispositions coupled with new sources of retirement income; (4) wide local variations among metropolitan areas in the rate of migratory circulation; and (5) the intensifying phenomenon of urban population decline. Author

N74-35339# Environmental Protection Agency, Washington, D.C.
LEGAL COMPILATION: STATUTES AND LEGISLATIVE HISTORY, EXECUTIVE ORDERS, REGULATIONS, GUIDELINES AND REPORTS. SUPPLEMENT 2, VOLUME 1: PESTICIDES
Jan. 1974 66 p
Avail: SOD HC $0.80

This text is designed to create a useful compilation of the legal authority under which the U. S. Environmental Protection Agency operates. These documents are for the general use of personnel of the EPA in assisting them in attaining the purposes set out by the President in creating the Agency. This Supplement contains the additions to and alterations of EPA legal authority covering pesticides not included in the original set of EPA Legal Compilations. This edition updates the Compilation through the 93rd Congress, First Session. Author

N74-35340# Environmental Protection Agency, Washington, D.C.
USER'S MANUAL FOR COLMIS: A COLLECTION MANAGEMENT INFORMATION SYSTEM FOR SOLID WASTE MANAGEMENT, VOLUME 1
1974 107 p
(SW-57C-Vol-1) Avail: NTIS HC $8.50

A computer program is presented for residential solid waste collection activities for environmental improvement. The program provides definite information on the operational aspects of collection and the costs involved in providing the source. It is also shown that the program is a planning and evaluating tool, providing specific data determining a fair day's work. M.C.F.

N74-35341# Committee on Public Works (U. S. House).
TO INSURE THAT CERTAIN BUILDINGS FINANCED WITH FEDERAL FUNDS UTILIZE THE BEST PRACTICABLE TECHNOLOGY FOR THE CONSERVATION AND USE OF ENERGY
Washington GPO 1973 56 p Hearing on H.R. 11299 and H.R. 11565 before Subcomm. on Energy of Comm. on Public Works, 93d Congr., 1st Sess., 27 Nov. 1973
(GPO-26-489) Avail: Subcomm. on Energy

Hearings were held before the Energy Subcommittee of the Committee on Public Works on the conservation and use of energy in buildings financed with Federal funds. The bills, H.R. 11299 and H.R. 11565, also cover the technology necessary for conservation. E.H.W.

N74-35342# Committee on Public Works (U. S. House).
FUEL AVAILABILITY AND ALLOCATION IN THE UNITED STATES
Washington GPO 1974 176 p Hearing before Subcomm. on Energy of Comm. on Public Works, 93d Congr., 2d Sess., 4 Feb. 1974
(GPO-31-711) Avail: Subcomm. on Energy

A Congressional hearing was conducted to examine the impact of the gasoline shortage on gasoline stations and motorists in various parts of the country. Emphasis was placed on the New Jersey area as being typical of the problems experienced by the Eastern Seaboard states. The hearing consisted primarily of testimony provided by selected witnesses and investigating personnel. Specific examples of the inconveniences resulting from the fuel shortage are documented by written and photographic evidence. The need for more equitable distribution of fuel resources, especially gasoline, is stressed. Author

N74-35343# Committee on Interstate and Foreign Commerce (U. S. House).
SUMMARY OF MAJOR PROVISIONS OF STANDBY ENERGY EMERGENCY AUTHORITIES ACT (H. R. 13834)
Washington GPO Apr. 1974 6 p Prepared by the staff for the Comm. on Interstate and Foreign Commerce in connection with the Committee's consideration of H.R. 13834, 93d Congr., 2d Sess., Apr. 1974
(GPO-31-024; H-Print-22) Avail: Comm. on Interstate and Foreign Commerce

The differences between the standby energy emergency authorities act, and the conference agreement on the emergency act (S.2589) are summarized along with the major provisions of H.R. 13834. F.O.S.

N74-35344# Committee on Interior and Insular Affairs (U. S. House).
NATIONAL ENERGY RESEARCH
Washington GPO 1974 587 p refs Hearings on H.R. 6602 and related bills before Subcomm. on the Environment of Comm. on Interior and Insular Affairs, 93d Congr., 16 and 23 May 1973; 13 Jun. 1973; 10 Dec. 1973; 18 Dec. 1973; 31 Jan. 1974; 1 and 19 Feb. 1974
Avail: Subcomm. on the Environment

A Congressional hearing was conducted concerning National energy research problems. Bills were proposed to establish a National program for research, development, and demonstration of fuels and energy technologies, and for the coordination and financial supplementation of Federal energy research and development. The provisions of the National Energy Research and Development Policy Act of 1973 are explained. The powers, functions, and controls exercised by various Federal agencies for improved use of fuel resources are explained. Author

N74-35345# Committee on Commerce (U. S. Senate).
RESOURCE CONSERVATION AND RECYCLING, PART 3
Washington GPO 1974 185 p refs Hearings on S. 2753 before Special Subcomm. on Sci., Technol., and Commerce of Comm. on Commerce, 93d Congr., 2d Sess., 17-18 Jan. 1974
(GPO-29-572) Avail: Special Subcomm. on Sci., Technol., and Commerce

Projections of an impending increase in solid waste generation many times greater than population growth prompted a Congressional hearing whose purpose was to initiate a multiple set of economic and other incentives for improving solid waste

disposal and recycling efforts. The utilization of waste energy is discussed, with particular reference to the CPU-400 solid waste disposal pilot plant which is expected to have the capability of consuming approximately 600 tons per day of municipal solid waste in order to produce 12,000 kilowatts of electric power per day. Other experimental units sponsored by utility companies which combine pyrolysis, gasification, and combustion processes to produce energy from solid waste are described. The information presented is primarily concerned with solving resource management problems in California. A.A.D.

N74-35346# Committee on Interstate and Foreign Commerce (U. S. House).
CIVIL AERONAUTICS BOARD, OVERSIGHT
Washington GPO 1974 37 p Hearing before Subcomm. on Transportation and Aeron. of Comm. on Interstate and Foreign Comm., 93d Congr., 2d Sess., 7 Feb. 1974
(GPO-30-218) Avail: Subcomm. on Transportation and Aeron.

A Congressional investigation was conducted to investigate the problems confronting the commercial air lines and the assistance which may be provided by the Civil Aeronautics Board to assist in alleviating some of the problems. Testimony of selected witnesses during appearance before the investigating committee is presented. Subjects discussed include the legislation to protect air transportation consumers during labor-management disputes, the competition for traffic with foreign countries, and efforts to overcome the effects of the fuel shortage on airline operations. Author

N74-35347# Committee on Commerce (U. S. Senate).
ENERGY AND ENVIRONMENTAL OBJECTIVES, PART 1
Washington GPO 1974 40 p refs Hearing before Subcomm. on Environment of Comm. on Commerce, 93d Congr., 2d Sess., 4 Feb. 1974
(GPO-30-912) Avail: Subcomm. on Environment

A hearing before Congress explored the potential compatibility of the energy shortage with environmental objectives, especially in terms of identifiable impacts of standards and regulations imposed by the Environmental Protection Agency intended to encourage public and private conservation measures. Topics discussed include solid waste energy utilization, electric power plant conversion from oil to coal, the retrieval and recycling of metals, paper, and glass, and continuing research in automotive emission control technology. A.A.D.

N74-35348# Defence Research Board, Ottawa (Ontario).
[CANADIAN DEFENCE RESEARCH ESTABLISHMENT PROGRAMS]
1973 49 p
(DR-222) Avail: NTIS HC $5.50

The activities during 1973 at the Defence Research Board's Headquarters in Ottawa and its seven research establishments across Canada are reviewed. Certain programs are selected to provide a conspectus of the kinds of research with which the Board concerns itself. Author

N74-35349# National Aeronautical Lab., Bangalore (India).
[MULTIDISCIPLINARY RESEARCH AND DEVELOPMENT ACTIVITIES] Annual Report, 1972 - 1973
1973 113 p
Avail: NTIS HC $8.75

Research and development activities are discussed for the transfer of technology. Projects investigated include the fields of aerodynamics, propulsion, structural sciences, materials science, electronics, instrumentation, and mathematical sciences. M.C.F.

N74-35350*# Battelle Columbus Labs., Ohio.
A FULL-SCALE FIRE PROGRAM TO EVALUATE NEW FURNISHINGS AND TEXTILE MATERIALS DEVELOPED BY THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION Final Report
L. J. Hillenbrand and J. A. Wray Washington NASA Sep. 1974 142 p refs
(Contract NASw-1948)
(NASA-CR-2468) Avail: NTIS HC $4.75 CSCL 11D

A program of experimental fires was carried out to establish the advantages offered by new materials for improved fire safety. Four full-scale bedrooms, differing only in the materials used to furnish them, were built and burned to provide comparative data on the fire hazards produced. Cost and availability differences were not considered. The visual evidence provided by TV and photographic coverage of the four experimental room fires showed clearly that the rooms responded very differently to a common ignition condition. Resistance to the ignition and spread of fire was substantially improved in the rooms furnished completely or partially with the new materials. Author

N74-35351# Committee on Public Works (U. S. Senate).
A LEGISLATIVE HISTORY OF THE CLEAN AIR AMENDMENTS OF 1970 TOGETHER WITH A SECTION-BY-SECTION INDEX, VOLUME 1
Washington GPO Jan. 1974 796 p refs Presented by the Library of Congr. to Comm. on Public Works, 93d Congr., 2d Sess., Jan. 1974 Prepared by the Library of Congr., Environ. Policy Div.
(GPO-26-274) Avail: SOD HC $5.30

The compilation provides ready access to significant documents and debates that led to Public Law 91-604, the Clean Air Act Amendments of 1970. A complete reprint of the bill is included. A.A.D.

N74-35352# Committee on Public Works (U. S. Senate).
A LEGISLATIVE HISTORY OF THE CLEAN AIR AMENDMENTS OF 1970 TOGETHER WITH A SECTION-BY-SECTION INDEX, VOLUME 2
Washington GPO Jan. 1974 806 p refs Presented by the Library of Congr. to Comm. on Public Works, 93d Congr., 2d Sess., Jan. 1974 Prepared by the Library of Congr., Environ. Policy Div.
(GPO-26-274) Avail: SOD HC $5.35
For abstract, see N74-35351.

N74-35353# Committee on Public Works (U. S. Senate).
TRANSPORTATION AND THE NEW ENERGY POLICIES, PART 1
Washington GPO 1974 214 p refs Hearing before Subcomm. on Transportation of Comm. on Public Works, 93d Congr., 1st Sess., 11 Dec. 1973
(GPO-27-160) Avail: Subcomm. on Transportation

Transportation problems caused by new energy policies are discussed before the Subcommittee on Transportation. The subcommittee examined the following issues: (1) the future of the highway construction program, as it will be implemented following the passage of the Federal Aid Highway Act of 1973, (2) the questions surrounding the President's proposals for different speed limits for cars, trucks, and buses, and the House passed bill, which sets a national speed limit of 55 mi/hr, (3) the capacity of mass transit to handle the increased load of passengers resulting from lower supplies of gasoline for highway use, (4) the priorities which should be established for fuel allocation among the various mode of transportation, (5) the difficulties anticipated in moving foodstuffs and other essential goods to market, and (6) other economic dislocations which may result from adjustments required in transportation policies. E.H.W.

N74-35354# Committee on Public Works (U. S. Senate).
IMPLEMENTATION OF TRANSPORTATION CONTROLS, PART 2
Washington GPO 1974 515 p refs Hearing before Subcomm. on Environ. Pollution of Comm. on Public Works, 93d Congr., 2d Sess., 15 Mar. 1974
(GPO-32-311) Avail: Subcomm. on Environ. Pollution

Air quality, transportation control measures, fuel prices, and trends in urbanization are considered in a Congressional hearing whose emphasis was on the air pollution problems in Los Angeles County, California. Reactions to the emission control strategies to achieve the oxidant air quality standard proposed by EPA are documented. A.A.D.

N74-35355# Committee on Government Operations (U. S. Senate).
CURRENT ENERGY SHORTAGES OVERSIGHT SERIES (THE MAJOR OIL COMPANIES), PART 3
Washington GPO 1974 179 p Hearings persuant to Section 4, S. Res. 46 before Subcomm. on Investigations of Comm. on Govt. Operations, 93d Congr., 2d Sess., 22 Jan.

1974
R(GPO-28-575-PT-3) Avail: Subcomm. on Investigations

Statistical data which reflect net sales, capital expenditures, and gross production of crude oil and natural gas liquids by the major oil companies were presented before a Congressional inquiry whose purpose was to determine whether profits and cash earnings were within a fair margin. Prospects for U.S. energy self-sufficiency through new sources of oil were also explored, and the impact of oil import interruptions on the GNP was assessed. A.A.D.

N74-35356# Environmental Protection Agency, Washington, D.C.
USERS MANUAL FOR COLMIS: A COLLECTION MANAGEMENT INFORMATION SYSTEM FOR SOLID WASTE MANAGEMENT, VOLUME 2
1974 372 p
(SW-58C-Vol-2) Avail: NTIS HC $21.75

Flow charts are presented for the systems analyst and data processor. The program is written in FORTRAN 4 language and is structured for an IBM 360/370 computer system. A sample problem is given to insure the proper functioning of the program on the user's equipment. M.C.F.

N74-35357# Committee on Appropriations (U. S. House).
DEPARTMENT OF TRANSPORTATION AND RELATED AGENCIES APPROPRIATIONS FOR 1975. PART 1: DEPARTMENT OF TRANSPORTATION NATIONAL TRANSPORTATION POLICY
Washington GPO 1974 355 p refs Hearings before a Subcomm. of the Comm. on Appropriations, 93d Congr., 2d Sess., 5 Mar. 1974
(GPO-31-433) Avail: Comm. on Appropriations

Goals for a unified national transportation policy, which focus on service standards and technology developments at a low per capita cost, are outlined in hearings before Congress aimed at determining equitable guidelines for federal funding of DOT and its related agencies. All phases of transportation are discussed, including railroads, inland barge carriers, buses, rapid transit systems, highways, and light aircraft. Federal obligations to subsidize certain aspects of the transportation sector are considered. The energy crisis and its influence on mass transit development is described, along with proposals for economic regulation of the industry. A.A.D.

N74-35358*# Old Dominion Univ., Norfolk, Va.
URBAN TRANSPORTATION: PERSPECTIVES ON MOBILITY AND CHOICE
Michael Z. Sincoff, ed., Jarir S. Dajani, ed., George R. Arnold, John W. Bird, Curtis M. Brooks, ed., William E. Cobb, James E. Cross, Larry F. Darby, Norman H. Erb, John C. Ficht et al [1974] 196 p refs
(Grant NGT-47-003-028)
(NASA-CR-140584) Avail: NTIS HC $13.00 CSCL 13F

A study of urban transportation systems are presented characterized by intensive scrutiny of many ideas, philosophies, and academic perspectives. This report is intended to communicate some dimensions of the urban transportation problem to the general public. M.C.F.

N74-35359# Federal Railroad Administration Washington, D.C. Office of Research, Development and Demonstrations.
HIGH SPEED GROUND TRANSPORTATION ACT OF 1965 AND THE RAILROAD TECHNOLOGY PROGRAM 1973 Annual Report, Oct. 1972 - Sep. 1973
1973 205 p refs
(PB-233064/5; FRA-ORD/D-74-54; AR-7) Avail: NTIS HC $5.75 CSCL 13F

Studies on rail technology are reported for improved passenger and freight service, safety research, improved track, and rail and vehicle dynamics. The study evaluates the Washington-New York Metroliner and the Boston-New York Turbotrain Demonstration including rideship and mileage. Research on advanced systems such as tracked levitated, magnetically levitated, and tracked air cushion vehicle systems along with supporting technology, such as propulsion, communications and control, guideways and tunneling are also reported. GRA

N74-35360# National Academy of Sciences - National Research Council, Washington, D.C. Committee on Science and Public Policy.
MATERIALS AND MAN'S NEEDS. MATERIALS SCIENCE AND ENGINEERING Summary Report
Apr. 1974 245 p
(PB-232807/8; LC-74-2118; ISBN-0-309-0220-7) Avail: NTIS MF $2.25; National Academy of Sciences, 2101 Constitution Avenue, Washington, D. C. 20418 HC $5.75 CSCL 05A

The report focuses on the development and implementation of national strategies for the efficient use of national resources. It provides a comprehensive analysis and assessment of materials science and engineering, examines interactions with other areas of science and technology, and identifies research priorities not only from the standpoint of creative appeal but also in the context of societal goals, ecological constraints, and dwindling national resources. Its recommendations for research embrace the structure and properties of materials as well as their design, preparation and use. GRA

N74-35361# Analytical Mechanics Associates, Inc., Jericho, N.Y.
TURN MANEUVERING TACTICS Final Report, 1 Mar. - 31 Dec. 1973
Henry J. Kelley and Leon Lefton Dec. 1973 35 p refs
(Contract N00014-73-C-0328; NR Proj. 215-222)
(AD-782628; Rept-73-50) Avail: NTIS CSCL 15/7

Circling encounters between aircraft modelled in energy approximation are studied in a differential game setting. Capture is defined in terms of turn-angle and a derived altitude-match requirement. Target sets and their capture subsets are defined and the computation of boundaries discussed and illustrated. A sufficient condition quaranteeing capture of an optimally-evading opponent in a turning chase is obtained which involves energy-rate/turn hodograph figure comparison. A qualitative description of tactics is given. Some point-mass simulation results are presented for energy-turn maneuvers in a check of validity. Author (GRA)

N74-35362# General Dynamics/Convair, San Diego, Calif. Aerospace Div.
WEAPON SYSTEM COSTING METHODOLOGY FOR AIRCRAFT AIRFRAMES AND BASIC STRUCTURES. VOLUME 1: COST METHODS RESEARCH AND DEVELOPMENT Technical Report, Jul. 1972 - Sep. 1973
R. E. Kenyon and J. M. Youngs Dec. 1973 233 p refs
(Contract F33615-72-C-2083; AF Proj. 1368)
(AD-783639; AFFDL-TR-73-129-Vol-1) Avail: NTIS CSCL 01/3

This report presents the interim results of a study aimed at extending cost estimating techniques developed and demonstrated under a previous contract. The previous study resulted in two separate estimating methods: a trade study and a system costing method. These methods provided two essential estimating capabilities: the capability of assessing the relative difference in the cost of the basic structures attributable to variations in type of construction and material in an iterative fashion to support tradeoff studies during the preliminary design process, and the capability of accurately estimating total airframe costs in manhours and materials for selected design while retaining sensitivity to type of material and construction. (Modified author abstract) GRA

N74-35363# Institute for Defense Analyses, Arlington, Va. Program Analysis Div.
A QUANTITATIVE EXAMINATION OF COST-QUANTITY RELATIONSHIPS, COMPETITION DURING REPROCUREMENT, AND MILITARY VERSUS COMMERCIAL PRICES FOR THREE TYPES OF VEHICLES. VOLUME 1: EXECUTIVE SUMMARY Final Report
Morris Zusman, Norman Asher, Elliot Wetzler, Debbie Bennett, Selmer Gustaves, Gerald Higgins, and Carole Kitti Mar. 1974 59 p refs
(Contract DAHC15-73-C-0200)
(AD-778612; S-429-Vol-1; IDA/HQ-73-15739) Avail: NTIS CSCL 15/5

The report presents the results of the study which was divided

into the following three interrelated subtasks: (1) an analytical and empirical examination of cost-quantity relationships with the objective of laying the framework for other parts of the study and attempting to identify factors other than cumulative units that might be incorporated in the progress curve; (2) an examination of competitive procurements with the objective of examining quantitatively the effect of competition on selling price; and (3) a comparison of prices paid for similar military and commercial equipment with the objective of testing quantitatively the hypothesis that commercial procurement practices are superior to military procurement practices and that, as a result, commercial equipment costs less than similar military equipment. (Modified author abstract) GRA

N74-35166 Princeton Univ., N.J.
COST ANALYSIS
J. File *In its* A Fusion Power Plant Aug. 1974 p 508-525 refs (For availability see N74-35146 24-25)